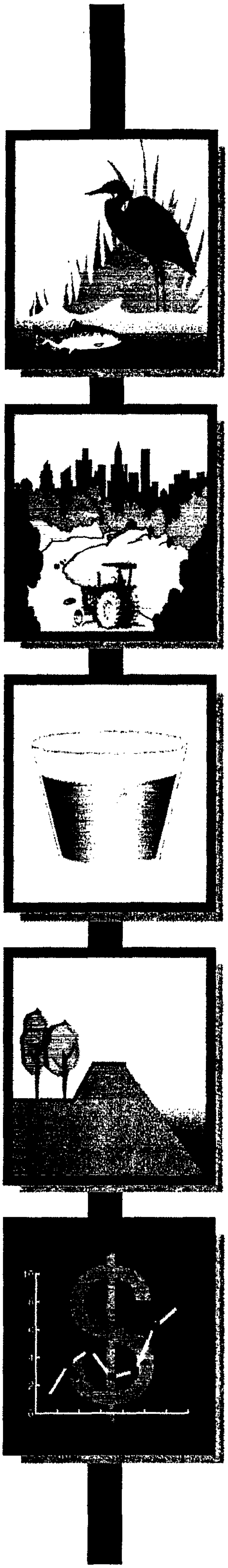

CALFED
BAY-DELTA
PROGRAM

Affected Environment and Environmental Impacts

Municipal & Industrial Water Supply Economics

Draft Technical Report
September 1997

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CALFED

DRAFT TECHNICAL REPORT MUNICIPAL AND INDUSTRIAL WATER SUPPLY ECONOMICS AFFECTED ENVIRONMENT

August 1997

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MUNICIPAL AND INDUSTRIAL WATER SUPPLY ECONOMICS

1.0 Summary

(TO BE PROVIDED)

2.0 Introduction

The purpose of this technical report is to provide a description of the affected environment for resources associated with M&I water supply economics. In order to accurately describe the affected environment for M&I water supply economics, it is necessary to define not only the current conditions but also the historical conditions. The historical conditions are described to place current conditions in perspective. This report describes the relevant regulatory context, historical M&I water use and cost trends, and existing M&I water use and costs for the study area. The current and historical conditions will be described in this report for each of the five regions within the study area: Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and Other SWP Service Areas. The executive summary contained in this technical report, in conjunction with other information, data, and modeling developed during pre-feasibility analysis, will be used to prepare the "Affected Environment" section of the Programmatic EIR/EIS.

Several assessment variables have been identified to provide ways of measuring and comparing the potential effects of the proposed and alternative CALFED actions on M&I water costs and economics. The key assessment variables are:

- Water supply and shortage costs,
- Water treatment and other water quality costs, and
- Water conservation costs.

3.0 Sources of Information

The primary sources of data used in this description were provided by the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation). DWR's Bulletin 166-4 (1994a), "Urban Water Use in California," provides detailed information on water use for individual providers and is used as the primary source of information on historical and current M&I water use. Bulletin 160-93, "The California Water Plan Update" (1994b), provides population data and regional-level estimates of water demand and supply. Data on M&I deliveries of the Central Valley Project (CVP) and the State Water Project (SWP) are from Reclamation's 1996 "Municipal and Industrial Full-Cost Water Rates" and from DWR's Bulletin 132-93, "Management of the California State Water Project" (1994c), respectively.

These sources have been supplemented with data supplied by individual providers concerning their water rates and water supply plans. Some providers have supplied recent water supply studies and other relevant documents. In general, little data are available for small providers and residential use outside defined water districts. For the South Coast Region, additional information is obtained from Metropolitan Water District of Southern California 's (Metropolitan's) Integrated Resources Plan (1996), and information about water quality problems was obtained from Metropolitan's Salinity Management Study Phase 1 Progress Report (Bookman Edmonston Engineering, 1997)

4.0 Environmental Setting

4.1 Study Area

The Delta region has been identified as the primary "problem area" by CALFED. This region consists of the legally defined Delta, Suisun Bay to Carquinez Strait, and Suisun Marsh. This document also provides appropriate information to describe the affected environment "solution area." The solution area includes the Delta Region and other areas in California that may affect or be affected by potential CALFED actions. The solution area, exclusive of the Delta problem area, consists of the service areas of M&I water providers who obtain water exported from the Delta. Water is exported by facilities owned by the SWP and the CVP. A map of the study area is provided as Figure 1, and a map of CVP and SWP key facilities is provided as Figure 2.

For the purposes of economics, the specific groups of affected persons must be described. The term "provider" includes all persons having a direct economic stake in the water supply and costs of the provider. End-users of water, shareholders in private water utilities, and any public or private interests who pay any part of the costs or receive the benefits of water service qualify.

The providers may be affected by CALFED actions in many ways. For example, any Delta M&I provider may be affected by CALFED actions that directly or indirectly affect land use. M&I water supply economics is concerned only with CALFED actions that may affect M&I provider water supplies or costs, including costs of potable water treatment.

4.2 Regulatory Context

Water rights define the terms and conditions of M&I water use. Water rights are a right of use, not ownership; and are subject to changing regulations that condition the timing, quantity, place, and type of use. Water diversions from the Delta are allowed under riparian or appropriative water rights. Riparian landowners have a right to divert a portion of the natural flow for reasonable and beneficial use on the owner's land within the watershed.

In case of water shortage, users must share in the available supply according to each owner's reasonable requirements and uses (Jones & Stokes Associates, 1995). Appropriative water rights are based on a history of beneficial use rather than location adjacent to the water supply. Appropriative rights established after 1914 require a permit from the State Water Resources Control Board (SWRCB) (Thomas 1992.).

Diversion and storage by the CVP are allowed under appropriative rights. Permits for CVP were first issued in 1958 (Decision [D]-893), and permits for SWP were issued in 1967 (D-1275 and D-1291). The Delta Protection Act of 1959 declared that the

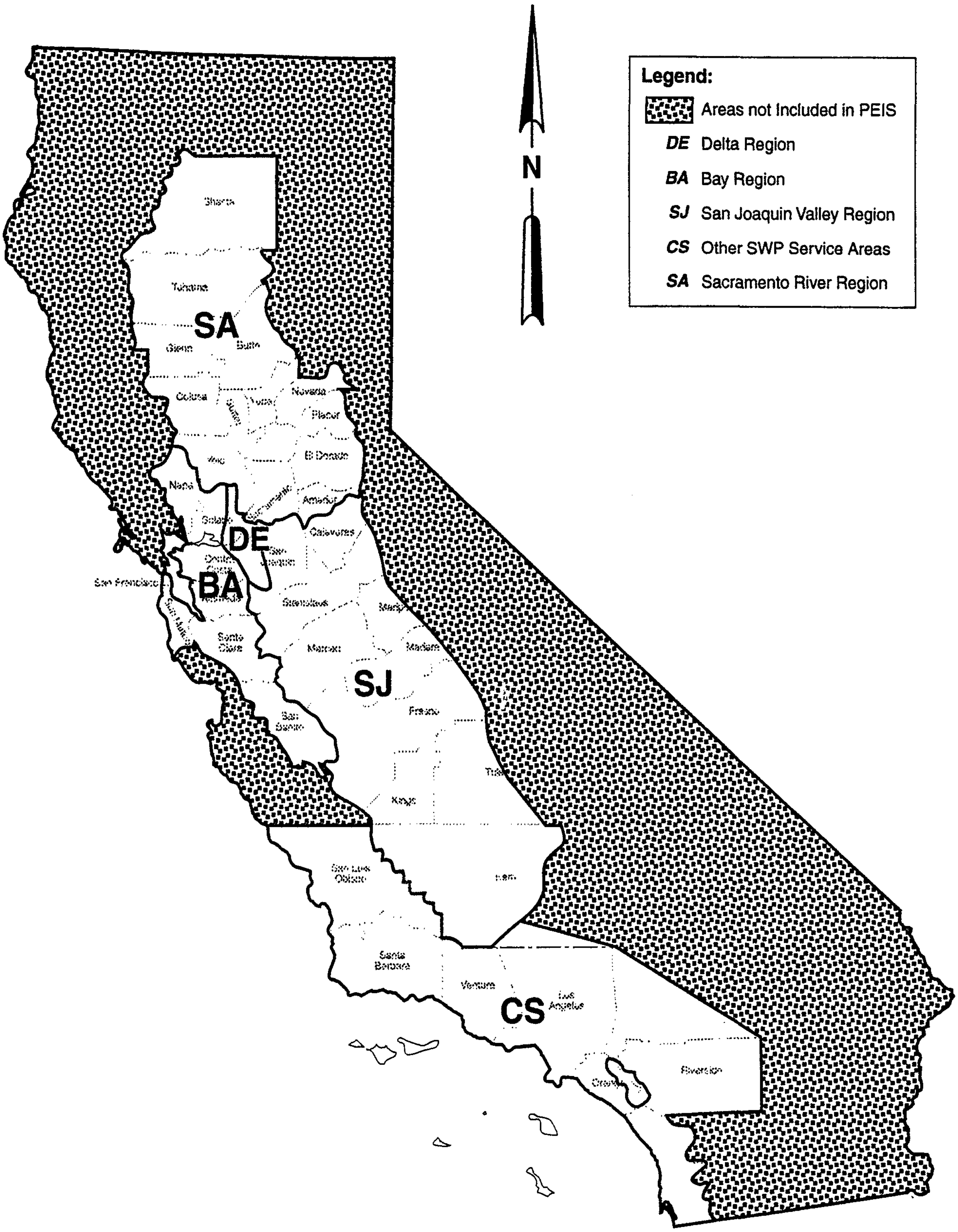

FIGURE 1
M&I WATER SUPPLY ECONOMICS STUDY AREA

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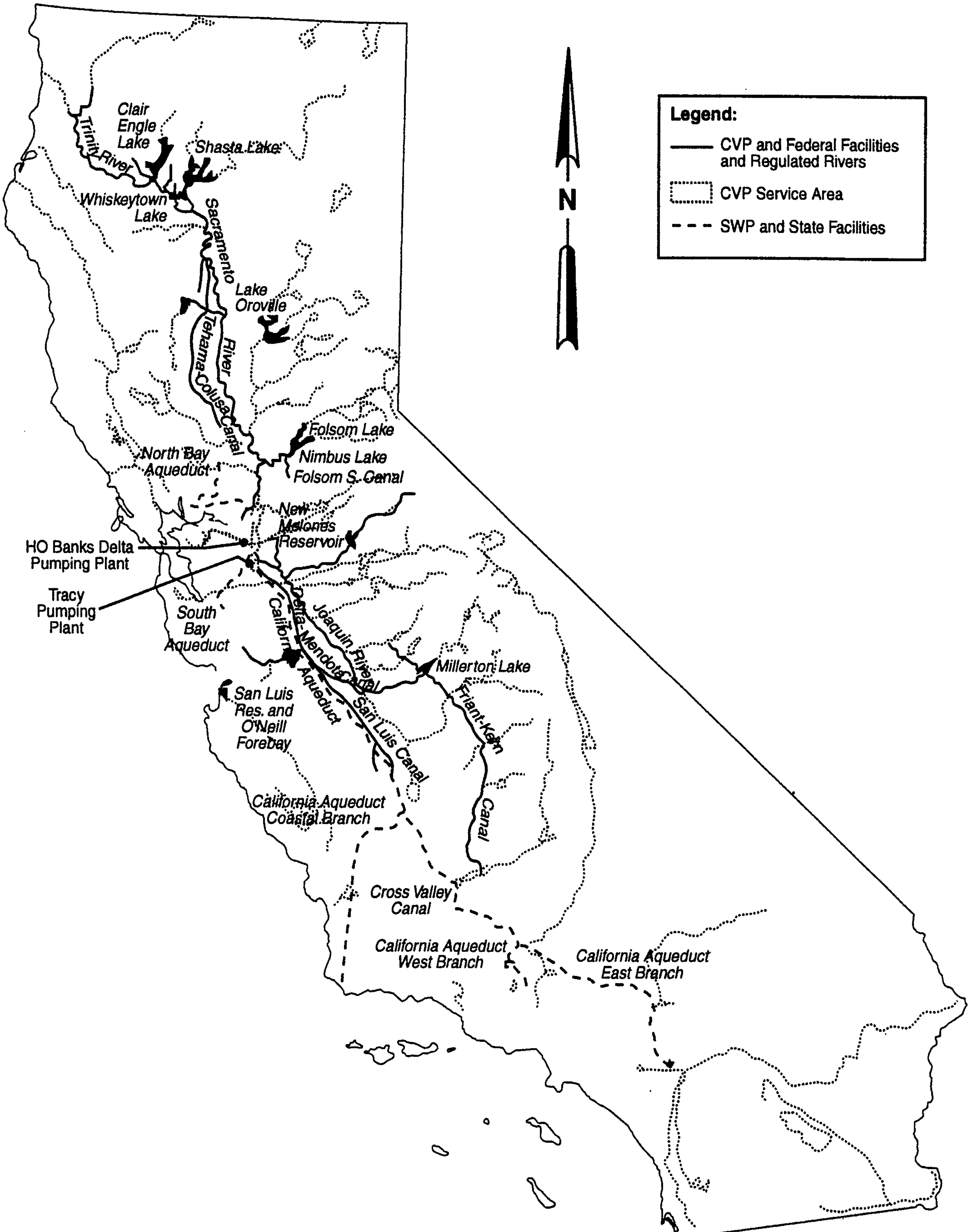

FIGURE 2
CENTRAL VALLEY PROJECT AND STATE WATER PROJECT FACILITIES

139888.A5.ZZ CVP & SWP Facilities 7-2-97sbm maintenance of an adequate water supply for urban use and for export to water-deficient areas, among other uses, was necessary. D-1485, adopted by SWRCB in 1978, required SWP and CVP to meet Delta water quality standards. D-1630 was proposed in 1992 but withdrawn, and Delta export operations have been guided recently by D-1485; the Endangered Species Act; the Bay-Delta Agreement of December 15, 1994; the Coordinated Operations Agreement between SWP and CVP; and the Central Valley Project Improvement Act (CVPIA) of 1992.

The SWP is involved in several initiatives that may affect SWP M&I water supplies. Especially, the Monterey Agreement will 1) allow water to be allocated in proportion to each contractor's share of entitlements with no initial reduction in agricultural supplies, 2) retire 45,000 acre-feet (AF) of agricultural entitlement, 3) transfer 130,000 AF of entitlement from agricultural to urban contractors by willing sale, 4) transfer control of the Kern Fan Element to designated agricultural contractors, and 5) change the way in which Castaic Lake and Lake Perris may be operated.

M&I water providers are also subject to laws involving water quality. California's Porter-Cologne Water Quality Control Act requires the adoption of water quality control plans by nine Regional Water Quality Control Boards (RWQCBs). The plans are subject to approval by the SWRCB and the U.S. Environmental Protection Act (EPA). Anyone who discharges or proposes to discharge waste must file a report for approval of applicable permits by appropriate RWQCBs.

The 1974 Federal Safe Drinking Water Act (Act) requires EPA to set national standards for drinking water quality. The 1986 amendments set deadlines for standards for specific contaminants; increased the number of contaminants that must be monitored; and strengthened enforcement, groundwater, and technical assistance programs. The Act allows states to set and enforce their own standards, as long as the state's standards are at least as protective as the federal standards. The 1996 amendments reform the standard-setting process used by EPA, require EPA to work with states to develop source-water assessment programs, and establish a state revolving loan fund. California's Safe Drinking Water Act of 1976 requires the State Department of Health Services to administer the state law. The standards are described in the California Code of Regulations, Title 22.

4.3 Delta Region

The solution area is defined as the service areas of Delta M&I providers, including the Cities of Pittsburg, Antioch, Tracy, Brentwood, Isleton, parts of Stockton and Sacramento, and a variety of small communities and residential users located around the Delta. Figure 3 shows the location of important M&I water use within the problem area.

4.3.1 Historical Perspective

The human history of the Delta is characterized by changing cultures, economy, and population patterns. At the time Europeans first arrived, most of the Delta was inhabited by Miwok Indians. The early economy was largely fur trade. In the mid-1800s, steamboats and the gold rush increased commerce between San Francisco and Sacramento. Sedimentation from hydraulic mining had largely curtailed deep draft navigation by 1890. Settlement of the

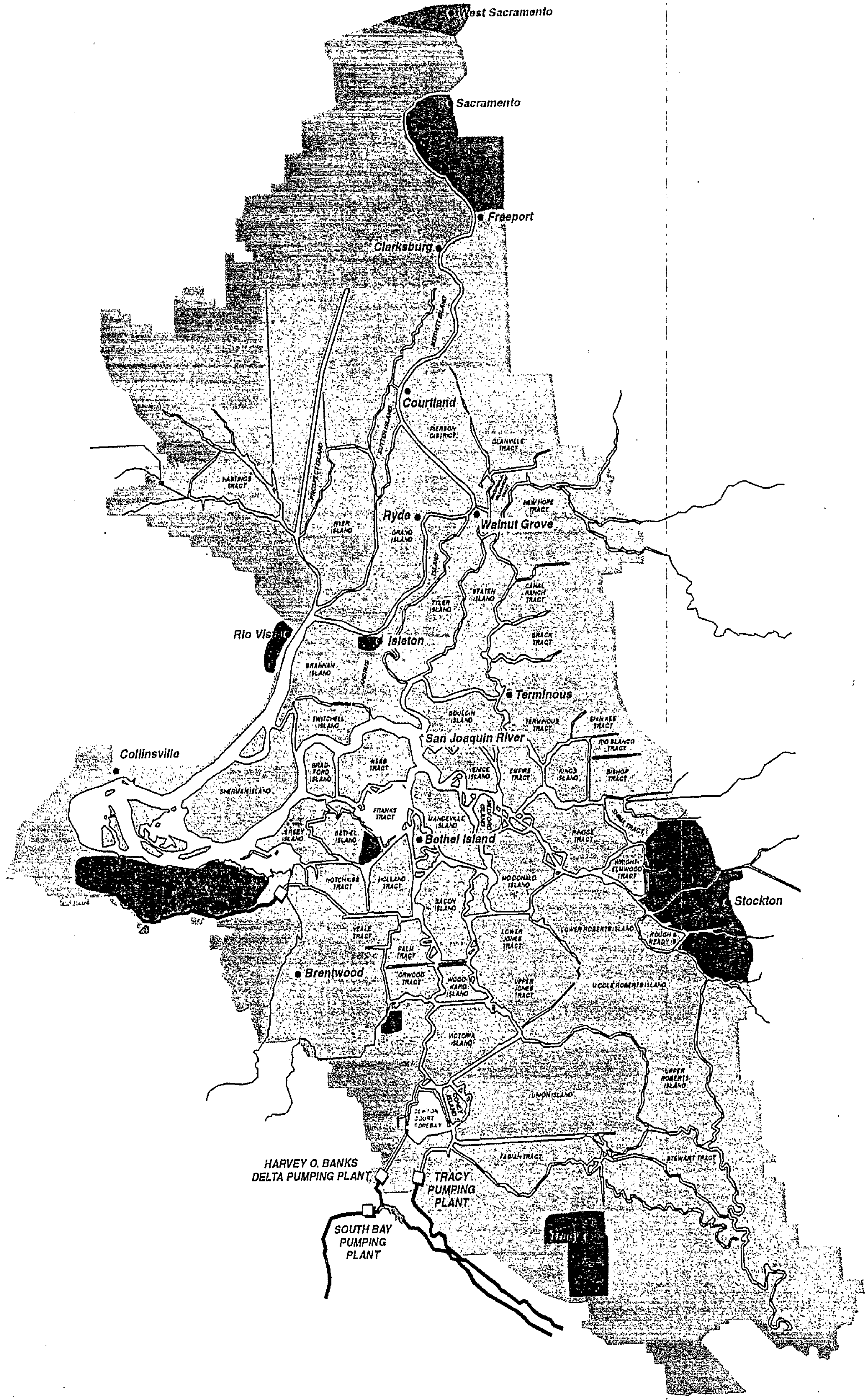

FIGURE 3
M&I PROVIDERS IN THE DELTA REGION

139888.A5.ZZ DELTA MAP 7-2-97DWR-SBM

Delta for agriculture and fisheries also increased during this period, and the advent of power dredges and more permanent reclamation led to permanent settlements. Flooding, siltation, and loss of commercial fisheries led to the abandonment of a number of Delta settlements over time (California State Lands Commission, 1991).

In the early 1900s, many small towns became more dependent on recreation, especially sport fishing, for their economic base. More recently, residential development associated with commuters has become the region's major source of economic growth, but agriculture and recreation still account for much of the region's economy in the more rural areas.

Much of the residential development in the Delta is now part of the Sacramento and Stockton metropolitan areas, and other towns and developments provide housing for Central Valley or coastal cities commuters. Until recently, most urbanization in California occurred near the coastal cities. In the last decade, there has been a relative shift in new development from the coast to more inland locations such as the Delta. This shift has been caused by several factors. For example, land available for new development is limited within the coastal regions. This lack of land caused a rise in home prices near the coast and fueled residential development inland. Areas that were once suburbs develop their own service industries, and the jobs created there make commuting from inland locations a feasible proposition. Total M&I water use in the Delta has increased over time with the increase in population. Figure 4 shows population trends for some Delta M&I providers.

4.3.2 Current Resource Conditions

Municipal water use within the Delta region occurs primarily near the edges of the region within the urban areas of Stockton, Sacramento, Pittsburg, and Antioch.

Water is also provided for municipal use in a number of small communities and individual residences located around the Delta. Table 1 shows population, water use, and cost data from DWR (1994a) for some major Delta providers. Industrial use occurs within the service areas of these providers, and a few large industrial users divert a significant share of total M&I use within the Delta. Figure 5 shows 1980 to 1990 use by the Delta providers as a percentage of 1990 use.

The City of Sacramento serves water to a section of the city within the Delta. Much of this area is commonly known as "the pocket" because of its location within a bend of the Sacramento River east of Interstate 5. The Delta also includes part of South Sacramento. The city provides water from the Sacramento and American rivers and from groundwater. The city does not divert surface water from within the Delta region.

West Sacramento serves M&I uses west of the Sacramento River and within the Delta. Data for West Sacramento are not available from DWR (1994a). Surface water and groundwater are used. Approximately 9,700 AF were diverted into the system in 1995, of which approximately 9,000 AF were surface water (Houston pers. comm., 1996). Surface water is taken from the Sacramento River under water rights and a CVP contract at a point within the Delta just north of Interstate 80.

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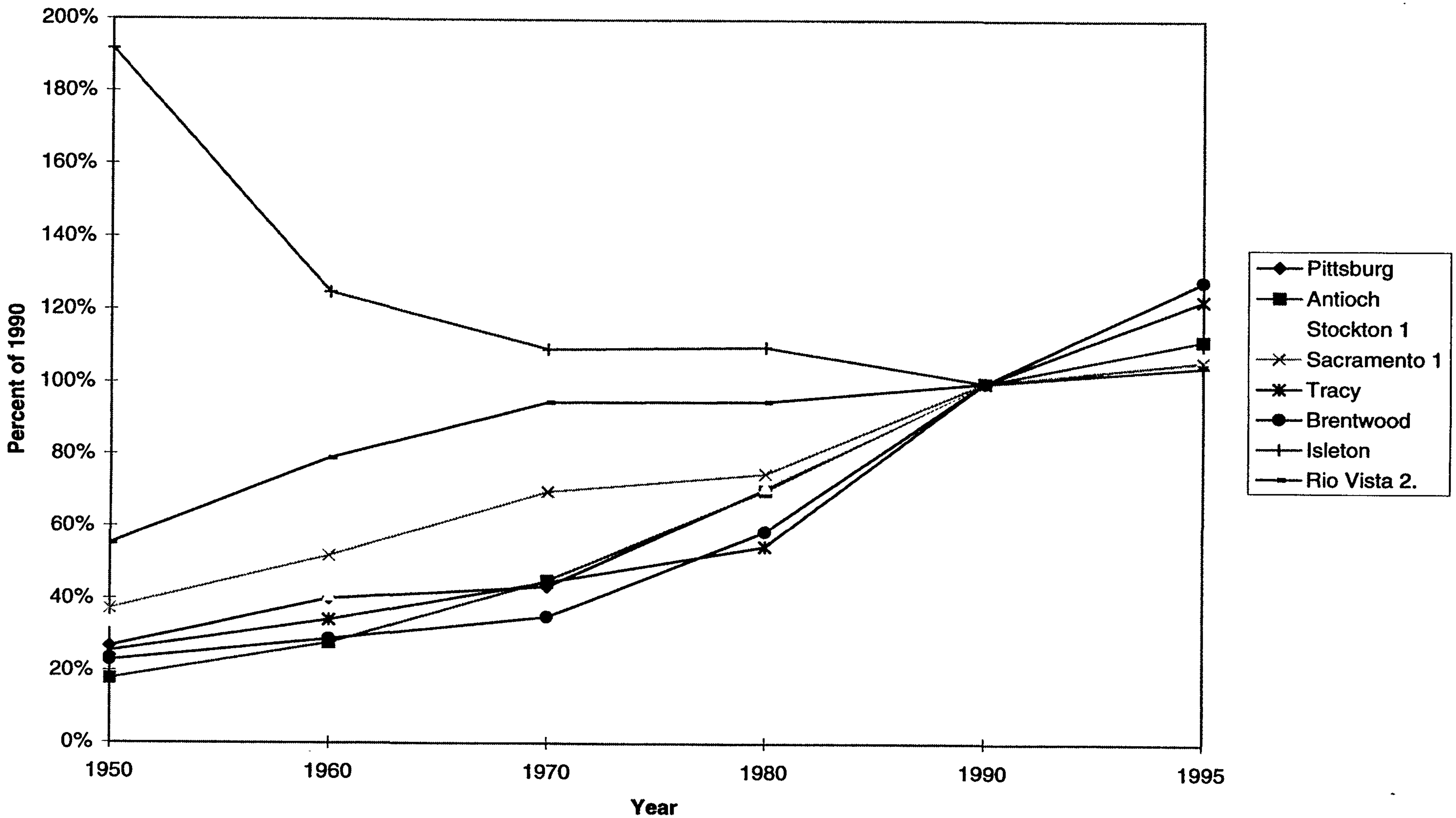

FIGURE 4
POPULATION TRENDS FOR SOME DELTA M&I PROVIDERS AS A PERCENT OF 1990 POPULATION

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Characteristic	Pittsburg	Antioch	Stockton[a]	Sacramento[a]	Tracy	Brentwood	Isleton	Rio Vista[b]
Current population	50,400	69,500	226,300	391,100	40,500	9,675	870	
1990 population	47,564	62,195	210,943	369,365	33,000	7,563	833	3,316
1990 mgd water into system	3,066	3,823	17,130	37,157	3,345	532	83	370
AF water into system 1990	9,411	11,734	52,578	114,048	10,267	1,633	255	1,136
1990 service connections	12,313	18,801	64,179	111,785	9,964	2,278	353	1,403
1990 gpcd	176	168	183	272	270	193	273	306
Percent purchased	100%	64%	52%	0%	42%	0%	0%	0%
Percent metered	99%	100%	100%	3%	100%	100%	100%	14%
Percent surface water	100%	100%	52%	95%	42%	0%	0%	0%
$/af average cost	$952	$702	$311	$165	$485			

Notes:
gpcd = Gallons per capita per day.
mgd = Million gallons per day.

[a] Only part of the provider is located within the statutory Delta.
[b] Borders the statutory Delta.

Table 1. Characteristics of Some Delta M&I Providers

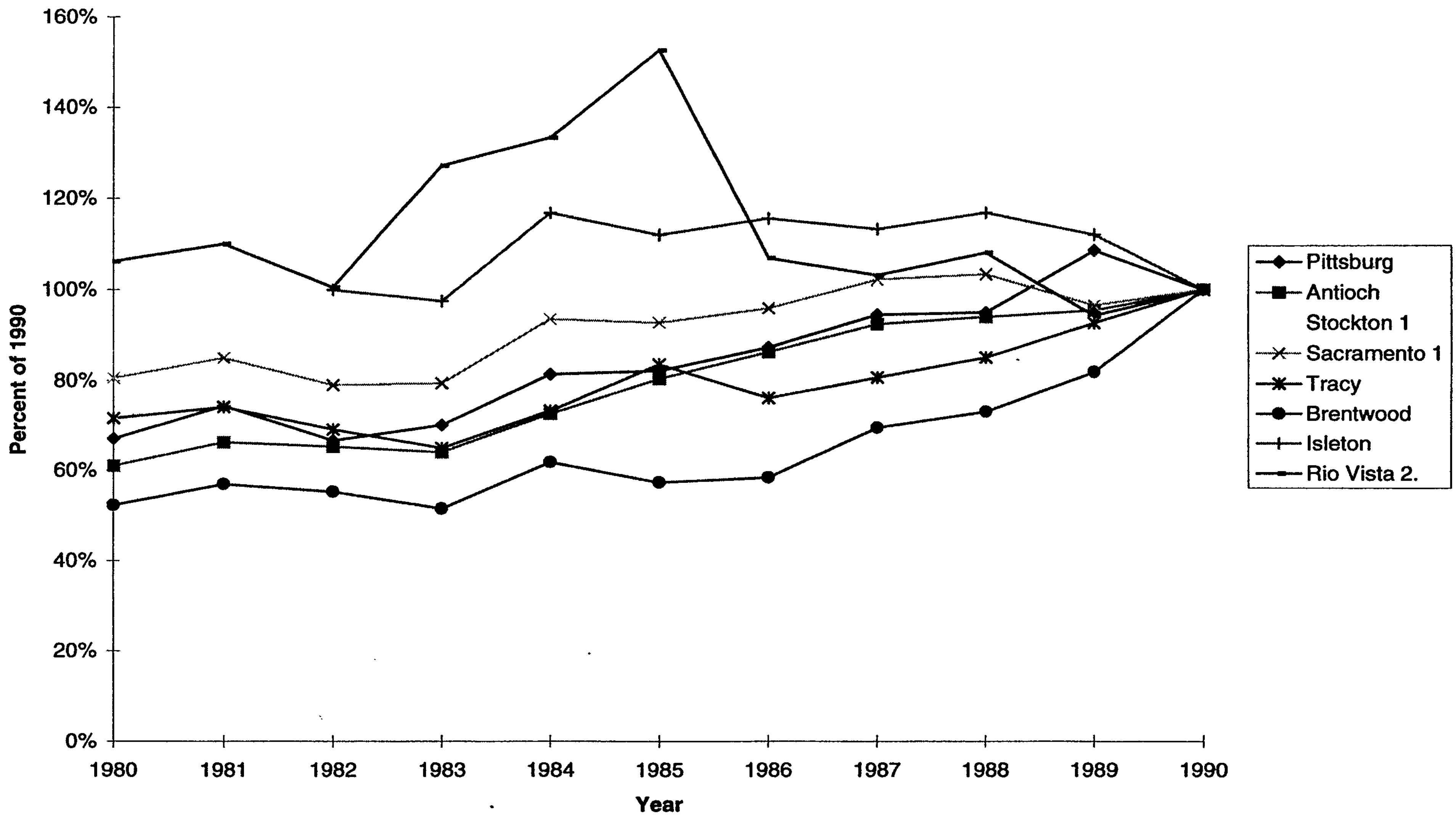

FIGURE 5
1980 TO 1990 M&I WATER USE AS A PERCENTAGE OF 1990 USE FOR SOME DELTA M&I PROVIDERS

The City of Stockton is served by three purveyors: the California Water Service Company, the City of Stockton, and San Joaquin County. Each of these agencies serves parts of the Delta. The only direct diversion of water from the Delta is for several golf courses and small landscape uses. Most M&I water is from groundwater, from the Calaveras River through Stockton East Water District, and from the Stanislaus River through CVP. The share of supplies provided by surface water and groundwater varies according to hydrologic conditions. The city currently supplies a small parcel within the Delta with reclaimed water.

The City of Stockton has submitted an application to SWRCB to divert up to 45,000 AF annually from the San Joaquin River downstream of its existing wastewater treatment plant. The diversion would recover "an amount of water equal to that discharged into the San Joaquin River at the City's Regional Waste Water Control Plant. . ." (City of Stockton, 1996). The additional water would be brought into the city for treatment or would be provided to agriculture in exchange for groundwater currently used for agriculture.

Contra Costa Water District (CCWD) serves lands within and outside the legal Delta in Contra Costa County. CCWD currently provides municipal water within the Delta for the Cities of Antioch and Pittsburg, and in Oakley Water District. Most of CCWD's water is obtained through a 195,000-AF contract for CVP water, which is pumped from the Delta into the Contra Costa Canal from Rock Slough. CCWD can also pump up to 26,700 AF annually from Mallard Slough and has agreed to use up to 21,000 AF per year of East Contra Costa Irrigation District (ECCID) water to serve M&I demands within ECCID.

CCWD operates two water treatment facilities: The Ralph D. Bollman Treatment Plant began operations in 1968 and can treat 90-100 million gallons per day (mgd); the Randall-Bold Water Treatment Plant began operations in 1992. The Los Vaqueros Reservoir Project will improve the quality and reliability of CCWD's M&I supplies.

The City of Antioch obtains its supply from CCWD and from a separate Delta diversion under a 7,670-AF right. The diversion and treatment facility can handle up to 8.3 mgd (9,300 AF/year), but water quality limits that amount. The salinity of the water at the diversion determines when water will be diverted and, consequently, the share of the city's water provided by the diversion as opposed to that supplied by CCWD. Typically, diversion ceases when salinity reaches about 200 parts per million (ppm), but diversion may continue at higher salinity if water quality (as a function of the tidal cycle) is expected to improve. As suggested by Table 1, Antioch is able to supply about 35% of its water needs with this diversion.

The City of Brentwood currently relies on groundwater for its water supplies, but the city has an agreement with CCWD to acquire up to 7,000 AF annually in the future. Some of this need will be met with the 21,000 AF CCWD has agreed to distribute for ECCID.

Additional towns and communities in the Delta region not included in Table 1 or in the discussion above include:

Bethany,	Freeport,
Bethel Island,	Hoods,
Byron,	Oakley,
Collinsville,	Ryde,
Cortland,	San Joaquin City,
Discovery Bay,	Terminous, and
Four Corners,	Walnut Grove.

Most of these towns are served by a larger provider, a small district, or individual groundwater wells. The town of Oakley is served by Diablo Water District, which obtains raw water from CCWD. The City of Antioch is the purveyor for the Discovery Bay area. Bethel Island residential users are served by several small water districts.

Other industrial users within the Delta divert water under individual water rights. CCWD (1996b) lists the following industrial water users and their annual diversion right: Gaylord Container Corporation (28,000 AF), El Dupont De Nemours & Co. (1,405 AF), Tosco Corporation Lion Oil Division (16,650 AF), and USS Posco (12,900 AF). Dupont obtains most of its water needs through Diablo Water District.

All of these users, except for Dupont, also obtain water through CCWD. Shell Oil is also an important industrial customer for CCWD, diverting about 10,000 AF annually from the Contra Costa Canal. Total industrial water sales by CCWD varied from 27,000 to 48,000 AF from 1984 to 1993, accounting for about one-third of CCWD's raw water demand (CCWD, 1996c).

Costs of existing and additional water supplies for Delta providers differ substantially, depending on existing and potential sources of water. Existing raw water costs for CCWD are influenced by CVP rate-setting policies and the CVPIA. The 1996 CVP contract rate was $32.35 per AF. Water costs to wholesale buyers and at the retail level are also being affected by the Los Vaqueros Reservoir project. In the future, new water costs will probably be affected by water reclamation and water transfer costs. Water costs near Sacramento and Stockton are also affected by CVP policies. In many locations, raw water costs will be affected by groundwater development and extraction costs. Groundwater quality is an increasing concern in some areas, and quality may affect the choice of supply and water blending and treatment costs.

The City of Tracy currently obtains its water supplies from groundwater and a CVP contract. The 1996 CVP contract rate for Tracy was $37.02 per AF (Reclamation, 1996). In 1992, the City of Tracy filed a water rights application with SWRCB to divert water from the Delta in the vicinity of the Westside Irrigation District pump station on Wicklund Road (Bayley pers. comm., 1996). The City may also propose to convert existing agricultural rights to M&I uses as the land is developed, and may propose to have both of these supplies wheeled through the Delta Mendota Canal to its water treatment plant.

4.4 Bay Region

The Bay Region, for purposes here, includes areas served by any of four facilities that export water from the Delta for M&I use: the Contra Costa Canal of the CVP, the San Felipe Division of the CVP, the North Bay Aqueduct of the SWP, and the South Bay Aqueduct of the SWP. In addition, some other areas are affected because of water exchanges that occur involving the Hetch-Hetchy and South Bay aqueducts.

4.4.1 Historical Perspective

From approximately 1900 to the present, California's population grew exponentially. Until recently, much of this growth was concentrated in the coastal areas. A state population of about 5 million in 1930 doubled by 1950 and doubled again by 1970. The rate of increased growth slowed between 1970 and 1990, when 10 million people were added to the state's population. The state's population as of 1990 was 30 million people (Carter and Nuckton, 1990; DWR, 1994b). Figure 6 shows population in DWR's San Francisco Bay Region from 1963 to 1990, and projected population to 2000. Population increased from about 4.537 million in 1970 to 5.484 million in 1990, for an annual growth rate of 2.25 percent. The growth rate slowed between 1990 and 1995.

Early in the state's history, population growth along the coast outstripped the ability of the coast's small and seasonally dry watersheds to provide adequate water supplies. Urban providers built projects, such as Hetch-Hetchy, to bring water from more reliable supplies. Continued growth led to projects such as the SWP and CVP, which generally move water from the north and east to the south and west.

Per capita use has been affected by several trends. Increased real incomes and new water-using technologies increased per capita use. As urbanization spread eastward within the region, the warmer climate and increased average lot size increased average per capita use. More recently, urban water conservation measures have dampened these trends. Table 2 shows three measures of per capita water use in DWR's San Francisco Bay Region in 1963, 1968, 1980, and 1990. Since 1968, per capita use has increased slightly, probably due to new residential development in the warmer, more inland portions of the region.

4.4.2 Current Resource Conditions

Three subregions within the Bay Region are internally independent in terms of water supply: the North Bay, the South Bay, and CCWD. The North Bay consists of SWP entitlement holders served by the North Bay Aqueduct (NBA) of the SWP and others who have used or could use this facility in exchanges. Two water districts are served by the NBA: Napa County Flood Control and Water Conservation District (NCFCWCD), and Solano County Flood Control and Water Conservation District (SCFCWCD). NCFCWCD serves SWP water in southern Napa County. SCFCWCD serves the cities of Vallejo, Vacaville, Fairfield, Benicia, and Suisun. The two districts have transferred water and obtained surplus water through the facility. In addition to SWP entitlement water, Vallejo receives water- rights water through the NBA.

Year	All Uses	Agency Only	Residential Only
1990	193		106
1980	180		
1968	179	164	
1963		146	

SOURCES:
DWR 1994, 1983, and 1970.

Table 2. Gallons per Capita per Day Water Use, San Francisco Region, 1963-1990

The South Bay is served by the South Bay Aqueduct, an SWP facility, and through CVP contract supplies supplied through the San Felipe Division. Three SWP entitlement holders—Alameda County Water District, Alameda County Zone 7, and the Santa Clara Valley Water District (SCVWD)—are located in the South Bay. SCVWD is also served by the San Felipe Unit of the CVP and wholesales water in a large part of the south San Francisco Bay.

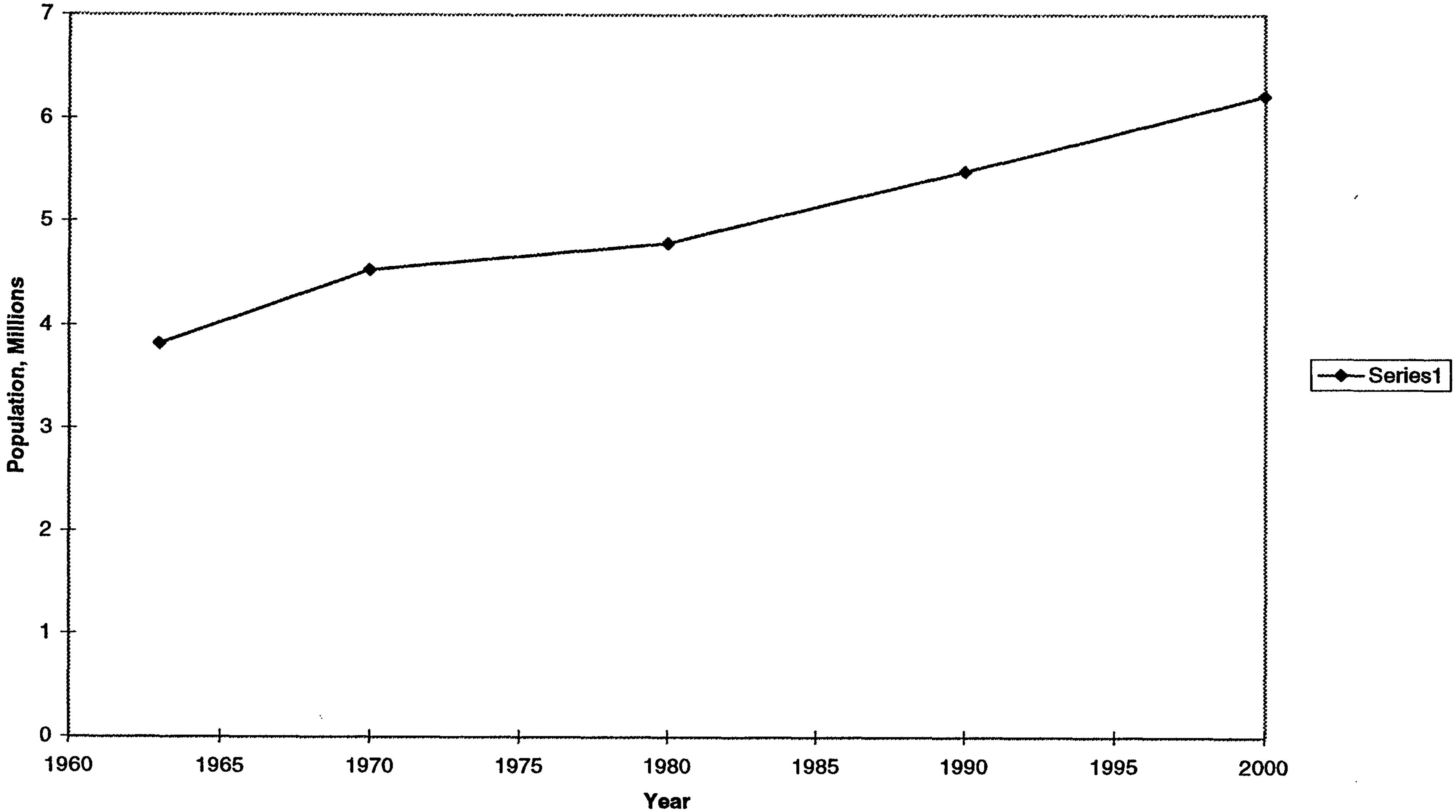

FIGURE 6
BAY REGION POPULATION TREND, 1983 TO 1990, AND 2000 PREDICTED

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For purposes here, CCWD includes that portion of the District not within the Delta. This includes the cities of Concord, Walnut Creek, Pleasant Hill, and Martinez, and other areas south and west of the statutory Delta.

The Bay Area currently relies on the CVP and SWP for about 30 % of its urban water demands. Without East Bay Municipal Utilities District (EBMUD), the share rises to about 40 percent. Table 3 shows recent imports into the region through CVP and SWP facilities. These data show the influence of drought and reduced water allocations, especially in 1991 and 1992. Most imported water is delivered through the Contra Costa Canal and the South Bay Aqueduct, with smaller shares delivered through the CVP 's San Felipe Division and the North Bay Aqueduct. Table 4 shows characteristics of some Bay Area M&I providers.

Per capita use is generally largest in the southern and eastern parts of the region. Many providers are entirely reliant on water wholesalers for their supplies. Water users in the region are almost entirely metered, and groundwater is an important part of supply for some providers.

Water quality varies among the export facilities that serve the region. The North Bay Aqueduct intake is in the North Delta where water quality is often better than in the southern or western Delta. The CCWD intake is located in Rock Slough in the western Delta, where salinity is a major concern.

Costs of existing and future water supplies are affected by the mix of supplies and their costs. DWR (1994b) estimated that groundwater for urban use in the region costs $85 to $330 per AF. Costs of CVP supplies, which currently range from $32 to $95 per AF, will be affected by the CVPIA. DWR (1994a) estimated SWP unit water charges for North and South Bay contractors of $212 and $109 per AF, respectively. Because local water supplies are generally fully utilized, future supply increases are likely to come from additional water imports or reclamation. The region generally has adequate water supplies during average conditions, but supply deficits are a problem in dry conditions. Water transfers and conservation were used during the recent drought to attain balance between supplies and demand (CUWA, 1991), and this pattern could be expected to continue in the future.

4.5 Sacramento River Region

This region includes the CVP service areas of M&I providers in the Sacramento Valley and a small SWP service area in the Feather River basin. Most of the region is located in the Sacramento area and near Redding.

4.5.1 Historical Perspective

The first use of the Sacramento River Region was for grazing and trapping, but the first significant immigration into the region involved the gold rush period of 1849 through the late nineteenth century. Most of the population lived in mining communities in the foothills, and Sacramento grew first as a port for delivery of goods and people from San Francisco, and later as the terminus of the first transcontinental railroad. Agriculture developed to serve the mining communities, and the designation of Sacramento as the state capitol led to additional growth. Economic patterns in the twentieth century have mirrored national trends as services, trade, and government have become larger shares of the economy;

Water Source	1990	1991	1992	1993	1994
Central Valley Project					
Contra Costa Canal	186,679	153,363	109,576	93,267	134,903
San Felipe Unit	65,390	53,352	69,530	56,066	81,842
State Water Project					
North Bay Aqueduct	26,071	8,352	16,171	24,234	--
South Bay Aqueduct	156,737	50,259	76,661	124,180	--
Total	**434,877**	**265,326**	**271,938**	**297,747**	

NOTES:
Does not include water rights deliveries or water transfers.
-- = Not available.

SOURCES:
Reclamation, 1996; DWR 1996.

Table 3. M&I Water Delivered to the Bay Region from the Delta, 1990-1994 (AF)

Provider	1990 Population	1990 mg Water into System	1990 Service Connections	1990 gpcd	Percent Purchased	Percent Metered	Percent Surface Water	$/AF Average Cost
Vallejo	109,199	7,087	35,000	178	79	100	100	
Fairfield	77,211	5,405	19,088	192	100	100	100	
Vacaville	71,479	4,720	20,412	181	53	100	53	
San Francisco	723,959	31,685	164,892	120	0	100	100	$484
Palo Alto	56,000	4,465	18,912	218	100	100	100	
San Jose	873,714	41,154	201,150	129	47	100	55	$664
Santa Clara	93,800	7,988	23,031	233	38	100	38	
Sunnyvale	117,229	7,606	27,434	178	80	100	80	
Pleasanton	50,570	4,818	16,195	261	68	98	68	
Concord	190,000	12,107	54,538	175	100	100	100	

Table 4. Characteristics of Some Bay Region Providers

while mining and agriculture have declined in relative, if not absolute, terms.

Figure 7 shows population in DWR's Sacramento River Region from 1963 to 1990, and projected population to 2000. Population increased from about 1.227 million in 1970 to 2.209 million in 1990 for an annual growth rate of 8.26 percent. The growth rate slowed between 1990 and 1995.

Table 5 shows three measures of per capita water use in DWR's Sacramento River Region in 1963, 1968, 198,0 and 1990. Since 1968, average per capita use has declined, possibly due to smaller lot sizes and conservation measures in new residential developments.

Year	All Uses	Agency Only	Residential Only
1990	301		169
1980	305		
1968	351	289	
1963		263	

SOURCES:
DWR 1994, 1983, and 1970.

Table 5. Gallons per Capita per Day Water Use Sacramento Region, 1963-1990

4.5.2 Current Resource Conditions

The Sacramento Valley has relatively abundant water supplies of good quality in comparison to the other regions. The region also differs from the other regions in that it does not use M&I water exported directly from the Delta. Rather, the region is affected primarily because CVP project yield is allocated among all CVP water service contracts, and CVP yield could be affected by CALFED actions.

The major M&I water use in the region occurs within the Sacramento metropolitan area. Most surface water use in the region is diverted from the American River. Direct diversions from the Sacramento River may provide a larger share of supplies in the future. The other part of the region affected by CALFED actions is in and near the City of Redding. The CVP provides municipal water service to a large number of small M&I providers in the area.

Table 6 shows recent diversions for M&I use through CVP facilities. These data show the influence of drought and reduced water allocations, especially in 1991 and 1992. Most providers in the region have water service contracts that exceed their immediate needs; therefore, reductions in deliveries during the drought were not as noticeable as in some other regions.

Table 7 shows some characteristics of Sacramento area M&I providers. Per capita use rates are among the highest in the state, reflecting climate, landscaping, and pricing factors. Some providers are entirely reliant on the CVP for their supplies. A large share of water users in the region are not metered. Groundwater is the sole source of supply for some providers; however, some rely entirely on surface water deliveries, especially CVP water-service water. Water costs per AF delivered are generally low in comparison to other regions.

This region is almost entirely upstream of the Delta, and surface water quality is generally good to excellent. At times, drainage upstream of Sacramento from the Colusa Basin Drain and other return flows has resulted in loading of agricultural chemicals. Rice farmers have recently worked to manage drainage discharges to reduce this problem. Other water quality problems in the basin have involved mine drainage, wastewater, and urban runoff, but none of these problems are considered serious.

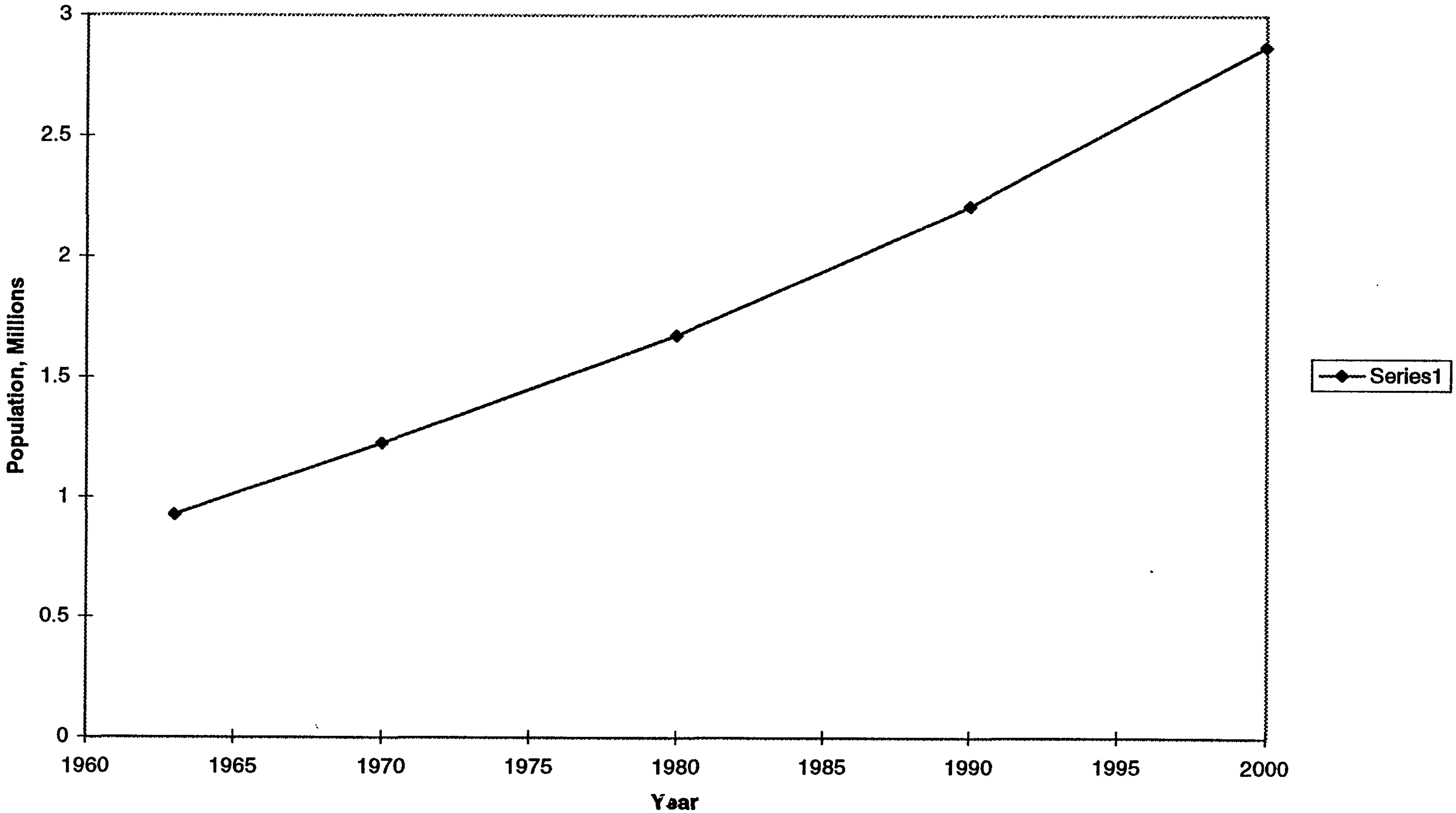

FIGURE 7
SACRAMENTO RIVER REGION POPULATION TREND, 1963 TO 1990, AND 2000 PREDICTED

C-002578

Water Source	1990	1991	1992	1993	1994
Central Valley Project					
Clear Creek Unit	1,451	659	2,460	2,076	2,329
Cow Creek Unit	3,342	1,817	3,206	5,342	6,674
Folsom Dam and Reservoir	27,454	40,743	23,360	20,895	30,693
Folsom South (SMUD)	5,829	3,600	3,564	1,673	1,727
Sacramento River	8,900	7,753	7,945	8,314	9,321
Shasta Dam and Reservoir	1,852	1,417	1,017	2,694	1,338
Spring Creek Conduit	638	337	777	885	688
Toyon Pipeline	2,471	2,071	2,537	2,164	2,479
State Water Project					
Feather River Area	1,448	866	2,128	3,476	--
Total	**53,385**	**59,263**	**46,994**	**47,519**	

NOTES:

Does not include water rights deliveries or water transfers.
-- = Not available.

SOURCES:
Reclamation, 1996; DWR 1996

Table 6. M&I Water Delivered to the Sacramento Region by the SWP and CVP

Provider	1990 Population	1990 mg Water into System	1990 Service Connections	1990 gpcd	Percent Purchased	Percent Metered	Percent Surface Water	$/AF Average Cost
Redding	66,462	6,890	21,112	284	70	100	70	$254
Sacramento, Citizens Utility	166,000	16,055	46,064	265	0	100	0	
Fair Oaks	38,005	4,949	12,641	357	95	6	95	
Roseville	44,685	4,642	17,249	285	100	10	100	
Sacramento, City of	369,365	37,157	111,785	276	0	2	95	$165
Orangevale/ Roseville	20,000	4,309	6,402	590	100	6	100	
Carmichael	38,550	4,191	10,830	298	60	5	60	

Metered percentage based only on available data for all service connections.

Table 7. Characteristics of Some Sacramento Region Providers

The region generally has adequate supplies, even during drought, and some providers have excess supplies in the form of unused contracts, water rights, and excess groundwater capacity. DWR (1994b) estimated that urban groundwater in the region costs $50 to $80 per AF. Some providers, however, are entirely dependent on CVP water service contract supplies for their water, and these supplies can be reduced in dry conditions. CVP contract supplies currently cost anywhere from $9 to $46 per AF (Reclamation, 1996). For these providers, drought conservation and water transfers may be used in the future during drought to obtain supply/demand balance.

4.6 San Joaquin River Region

The San Joaquin River Region includes only those M&I providers in the San Joaquin Valley with some current use or planned use of CVP or SWP supplies exported from the Delta. CVP water service contracts in the region are served by the Delta-Mendota or San Luis canals. SWP entitlements are served via the California Aqueduct.

4.6.1 Historical Perspective

The European history of the San Joaquin Valley Region began with settlement by the Spanish for cattle ranching. By the mid-1800s, gold mining to the north and east created a demand for agricultural products and led to the first large irrigation developments in the region. Large areas of wetlands such as Tulare Lake were reclaimed for agriculture, and the advent of the railroad expanded agricultural markets to the rest of the nation. Many early irrigation developments were private, but the federal government played a larger role in this century with multi-purpose projects on the eastside rivers and valley floor. Urban areas first developed to serve agriculture; but recent development has been more oriented to industry, services, tourism, and government.

Figure 8 shows population in DWR's San Joaquin River and Tulare Lake regions from 1963 to 1990, and projected population to 2000. Population increased from about 1.676 million in 1970 to 2.974 million in 1990, for an annual growth rate of 7.72 percent. The growth rate slowed between 1990 and 1995. Table 8 shows three measures of per capita water use in DWR's San Joaquin River and Tulare Lake regions in 1963, 1968, 1980, and 1990. Since 1968, per capita use has declined, probably in response to smaller lot size, more use of modern conservation in new housing, and perhaps changing patterns of water use in industry and commerce.

Year	All Uses	Agency Only	Residential Only
Tulare Lake Region			
1990	301		202
1980	320		
1968	363	325	
1963		314	
San Joaquin Region			
1990	309		216
1980	355		
1968	436	338	
1963		317	

Table 8. Gallons per Capita per Day Water Use San Joaquin and Tulare Regions, 1963-1990

4.6.2 Current Resource Conditions

The largest CVP M&I water users are Avenal, Coalinga, Huron, Westlands Water District, and Tracy, but small amounts of M&I water are taken by a number of other districts. Stockton East is included in this group, with a CVP contract of 38,000 AF.

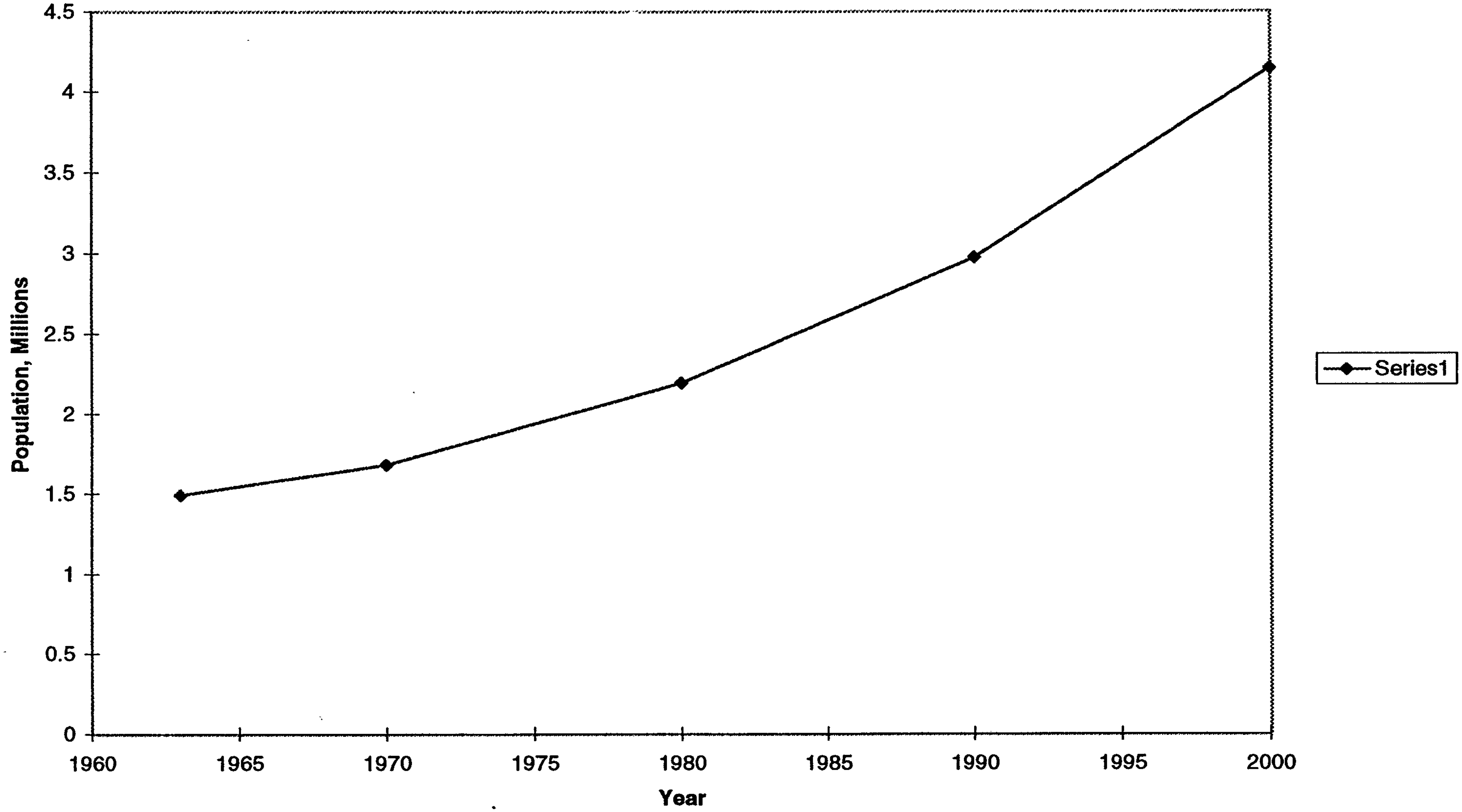

FIGURE 8
SAN JOAQUIN RIVER REGION POPULATION TREND, 1963 TO 1990, AND 2000 PREDICTED

M&I water use in the Friant Division of the CVP is not included. The City of Bakersfield obtains SWP M&I supplies through Kern County Water Agency (KCWA).

Table 9 shows recent imports into the region through CVP and SWP facilities. These data show the influence of the recent drought and reduced allocations, especially in 1991 and 1992. Most Delta water delivered into the region is provided to KCWA. This water is delivered for several uses within Kern County in exchange for groundwater pumped by the City of Bakersfield.

Table 10 shows characteristics of some San Joaquin Valley M&I providers. Per capita use rates are generally higher than in the coastal regions, reflecting climate and landscaping factors.

For the four providers with data available, two use both surface water and groundwater. The two smaller providers rely on imported water for all of their supplies.

Existing and future water supply costs are affected by the mix of water sources and their costs. Groundwater and surface water costs are important. DWR (1994b) estimated that groundwater for urban use costs anywhere from $70 to $270 per AF. In 1996, contract rates for CVP water were $18 to $66 per AF (Reclamation, 1996). DWR (1994b) estimated SWP unit water charges of $57 per AF. Additional groundwater development in some areas may be limited by water-quality concerns. Water transfers and conservation are likely future sources of supply in dry years.

4.7 Other SWP Service Areas

This region includes the service areas of all SWP entitlement holders south of Kern County. The single largest provider is Metropolitan Water District of Southern California (Metropolitan) in DWR's South Coast region. The South Coast M&I water demand exceeds the demands of all other M&I regions combined. The region includes Ventura, Los Angeles, and Orange counties; and the western portions of San Diego, Riverside, and San Bernardino counties.

The study area also includes service areas receiving SWP water in DWR's Central Coast Region, the Antelope Valley and Mojave River planning subareas of the South Lahontan region, and the Coachella planning subarea of the Colorado River region. Central Coast SWP contractors are Santa Barbara County Flood Control and Water Conservation District (SBCFCWCD) and San Luis Obispo Flood Control and Water Conservation District. These districts are served by deliveries through the Coastal Aqueduct of SWP.

4.7.1 Historical Perspective

The first European use of the Central and South Coast regions involved Spanish settlement for trade and cattle production. After statehood, the region grew quickly as agriculture, business, and industry took advantage of the region's warm Mediterranean climate. The rapidly expanding South Coast population soon required water imports from the east, and the Los Angeles Aqueduct, the Colorado River Aqueduct, the San Diego Aqueduct, and the SWP were developed to meet this need. The Los Angeles metropolitan area is now the second largest in the nation.

Figure 9 shows population in DWR's Central Coast, South Coast, and South Lahontan regions from 1963 to 1990, and projected population to 2000. This population increased from about 12.1 million in 1970 to 18.2 million in 1990, for an annual growth rate of

Water Source	1990	1991	1992	1993	1994
Central Valley Project					
Cross Valley Canal	459	407	297	0	0
Delta Mendota Canal	5,531	5,586	7,221	8,005	7,843
San Luis Canal	12,996	10,528	15,098	11,787	14,374
State Water Project					
Kern County Water Agency	127,837	33,122	56,305	94,220	--
Total	**146,823**	**49,643**	**78,921**	**114,012**	

NOTES:
Does not include water rights deliveries or water transfers.
-- = Not available.

SOURCES:
Reclamation, 1996; DWR 1996.

Table 9. M&I Water Delivered to the San Joaquin Region from the Delta, 1990-1994

Provider	1990 Population	1990 mg Water into System	1990 Service Connections	1990 gpcd	Percent Purchased	Percent Metered	Percent Surface Water	$/AF Average Cost
Stockton	210,943	17,130	64,179	222	52	100	52	$311
Huron	4,766	284	621	163	100	N/A	100	
Coalinga	8,450	1,032	2,665	327	100	16	100	
Bakersfield, CA Water	172,800	20,222	51,641	321	15	24	15	$263

Table 10. Characteristics of Some San Joaquin Valley Region Providers

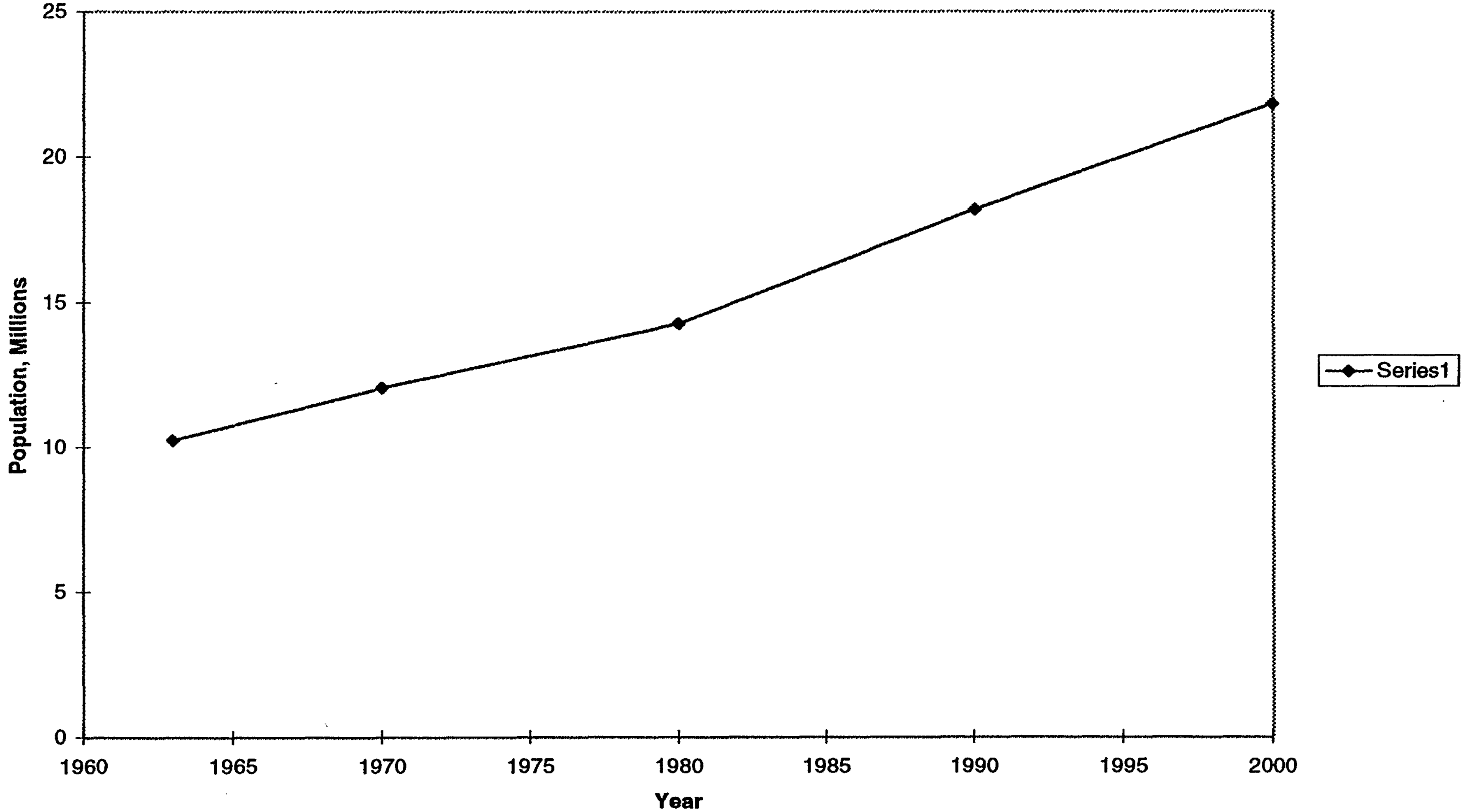

FIGURE 9
SOUTH COAST, CENTRAL COAST, AND SOUTH LAHONTAN REGION POPULATION TREND, 1963 TO 1990, AND 2000 PREDICTED

C-002585

4.4 percent. The population growth rate slowed between 1990 and 1995.

Table 11 shows three measures of per capita water use in DWR's Central Coast, South Coast, and South Lahontan regions in 1963, 1968, 1980, and 1990. Since 1970, per capita use in the South Coast Region has increased slightly, probably due to new residential development in the more inland, hotter portions of the region. Use per capita in the Central Coast Region has declined, probably due to high water prices and more intensive water conservation in this region.

Year	All Uses	Agency Only	Residential Only
South Coast Region			
1990	211		124
1980	191		
1968	179	173	
1963		167	
Central Coast Region			
1990	189		112
1980	210		
1968	194	165	
1963		148	
South Lahontan Region			
1990	278		175
1980	280		
1968	305	264	
1963		298	

Table 11. Gallons per Capita per Day Water Use, South Coast, Central Coast, and South Lahontan Regions, 1963-1990

4.7.2 Current Resource Conditions

Table 12 shows recent imports into the region through SWP facilities. These data show the influence of drought and reduced water allocations, especially in 1991 and 1992. SWP deliveries to Metropolitan declined 72 % from 1990 to 1991 and did not recover again until 1993. Similar delivery patterns were experienced by the other SWP M&I entitlement holders in the region.

DWR's Bulletin 160-93 (1994b) estimated that the South Coast Region will experience a 2020 supply deficit of 1.4 and 2.5 million acre feet in average and dry years, respectively, or enough to meet the demands of about 6.7 million persons in the average year. Most of this shortage would be eliminated with new supplies; especially reclaimed water and new yield from Colorado River, local and SWP improvements, and conservation. Still, a substantial supply deficit would remain.

Table 13 shows some characteristics of M&I providers in the region. Only those providers delivering more than 10,000 million gallons, or 30,700 AF, annually are included. In the South Coast Region, per capita use rates generally reflect distance from the coast. Most providers supply a mix of purchased and developed water, and almost all providers use a mix of surface water and groundwater supplies. The Central Coast Region exhibits some of the highest water prices and lowest per capita use rates in the state. For providers with data available, 100 % of customers are metered.

Metropolitan recently developed an Integrated Resources Plan as a policy guideline for future resource and capital development (Metropolitan 1996). The Preferred Resource Mix for 2020 includes: 512,000 AF annually of new conservation; 290,000 AF of new water recycling; 40,000 AF of groundwater recovery; dry-year yields of 220,000 and 400,000 AF from existing reservoirs and the Eastside reservoir, respectively; 200,000 AF of dry-year yield from conjunctive use; about 700,000 AF of additional dry-year SWP supplies; and 300,000 AF of water transfers from willing sellers.

Water Source	1990	1991	1992	1993
State Water Project				
Metropolitan Water District of Southern California	1,396,423	391,447	707,311	1,408,050
Other Southern California	189,483	51,249	105,090	193,092
Total	**1,585,906**	**442,696**	**812,401**	**1,601,142**

Does not include water rights deliveries or water transfers.

Sources:
Reclamation, 1996; DWR, 1996

Table 12. M&I Water Delivered to the Central Coast and South of Kern County from the Delta 1990-1993, acre-feet

Region/ Provider	1990 Population	1990 mg Water into System	1990 Service Connections	1990 gpcd	Percent Purchased	Percent Metered	Percent Surface Water	$/AF Average Cost
Central Coast Region								
San Luis Obispo	41,958	1,560	12,350	102	0	100	59	$890
Goleta	70,480	1,934	13,750	75	76	100	75	$1,381
Santa Barbara	85,571	3,079	24,146	99	61	100	68	$1,364
South Coast Region[a]								
Carson et al.	101,000	12,667	31,611	344	73	100	73	
Long Beach	429,433	24,448	87,923	156	65	100	65	$498
Los Angeles	3,485,398	218,809	635,698	172	73	100	89	$462
Glendale	180,038	10,144	32,778	154	93	100	93	$312
Pasadena	131,590	12,629	36,998	263	66	N/A	67	$331
Anaheim	266,406	24,064	55,500	247	49	100	49	
Fullerton	114,144	10,584	27,890	254	54	100	54	
Huntington Beach	181,519	12,530	48,571	189	53	100	53	
Santa Ana	293,742	16,665	43,491	155	25	N/A	25	
Riverside	226,505	22,217	66,348	269	8	100	8	$268
Ontario	133,179	12,101	28,019	249	46	100	46	
Rancho Cucamonga	101,409	13,810	32,567	373	46	100	59	
Fontana	75,000	10,411	28,000	380	100	100	30	
Mission Viejo	109,250	10,700	37,445	268	100	100	100	
El Cajon et al.	227,293	13,514	53,347	163	98	100	99	
San Diego	1,100,549	73,927	235,810	184	100	100	100	$576
Chula Vista and vicinity	135,163	15,986	60,673	324	87	100	96	
South Lahontan Region								
Palmdale	68,842	6,073	19,626	242	43	100	44	$488

[a] Only those providers with 10,000 million gallons per year or more.

Table 13. Characteristics of Some Central Coast, South Coast, and South Lahontan Providers

DWR (1994a) estimated that groundwater for urban use in the South Coast Region costs $45 to $190 per AF. There is little potential for new yield without intentional recharge or expensive treatment. DWR (1994c) estimated an SWP unit water charge in the southern California area of $206 per AF. The Integrated Resources Plan estimates the potential costs of future water supplies. Development, treatment, and distribution costs of new Colorado River Aqueduct supplies are expected to be about $250 per AF, but the yield of these options is limited by the conveyance capacity of the Colorado River Aqueduct. Additional storage, low-cost transfers, and additional SWP supplies would cost around $300 per AF, low-cost reclamation and high-cost transfers about $400 per AF, high-cost reclamation about $600 per AF, groundwater recovery about $700, and desalinization would cost more than $1,400 per AF.

Water quality, especially salinity, is an important economic and planning problem for the South Coast. Salinity can adversely affect the taste of drinking water; inhibit plant growth; accelerate depreciation of plumbing, appliances, treatment facilities, and pipelines; increase use of soaps and detergents; increase industrial costs; and increase costs of wastewater treatment and reclamation. Almost all of the available water sources in the region contribute salinity, but Colorado River supplies and degraded groundwater are the primary sources. Salinity concentrations have tended to increase over time as upstream development on the Colorado River has increased loads and reduced dilution, and water reuse has concentrated salinity in groundwater basins. Blending of supplies is often used to reduce average salinity. Metropolitan recently initiated a two-phase comprehensive salinity management study to develop information in support of regional salinity management policies and to coordinate interagency action to solve salinity problems (Bookman Edmonston Engineering, 1997). A number of possible salinity management actions have been identified for consideration in Phase II.

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CALFED

DRAFT TECHNICAL REPORT
MUNICIPAL AND INDUSTRIAL WATER SUPPLY ECONOMICS
ENVIRONMENTAL IMPACTS

August 1997

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MUNICIPAL AND INDUSTRIAL WATER SUPPLY ECONOMICS

1.0 Introduction

The intent of the CALFED Bay-Delta Program (Program) is to develop long-run solutions to problems affecting the San Francisco Bay/Sacramento-San Joaquin Delta estuary in Northern California. Overall, the effect of the Program is expected to be beneficial. However, specific Program components may have potentially adverse impacts.

The purpose of this technical report is to document, in a programmatic manner, the potential impacts of the program on municipal and industrial (M&I) water supply economics. The objective is to describe and analyze effects on M&I water supply economics that could result from the No Action Alternative or implementing any of the three Program alternatives. This report discusses potential impacts that may occur in the five regions within the study area: the Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and the Other SWP Service Areas. The report also contains a brief description of potential mitigation strategies designed to reduce Program impacts to a less-than-significant level. The executive summary contained in this technical report, in conjunction with other information, data, and modeling developed during pre-feasibility analysis will be used to prepare the environmental impacts section of the Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS).

2.0 Executive Summary

A partial analysis of M&I water supply economics is provided, and results from an even more limited analysis of water quality economics are shown. Qualitative analysis is provided for CALFED common programs, especially water quality and urban water conservation. Table 1 provides a summary of significance findings.

Impacts on water supply are analyzed using preliminary DWRSIM results and a model of M&I water supply economics. Based on the size of water supply increases from DWRSIM results, and assumptions concerning the allocation of these supplies, Alternatives 1C, 2B, 2E, 3B, and 3D through 3I are likely to have a significant beneficial impact on water supply economics for Central Valley Project (CVP) and State Water Project (SWP) M&I water providers. The significance of impacts on individual providers depends on the share of these water supplies as part of their entire water supply mix.

Potential benefits of the alternatives listed above, in terms of water supply costs avoided, are about $150 to $175 million annually under 2020 development conditions; additional gross benefits in a year during the critical period are roughly $180 million to $280 million under 2020 development conditions. Most of the benefits are obtained in the SWP service areas south of Kern County, where gross benefits in an average hydrologic year are $135 to $160 million and, during the critical period, $150 to $235 million annually. Benefits to all other regions in a critical period are roughly $30 to $55 million annually. These benefits would be less if water transfers from the Central Valley were allowed as an alternative supply, and they might be less if additional local water supply options were considered.

Costs of the CALFED storage and conveyance options are currently not available. Therefore, these costs have not been considered in terms of their effects on net benefits, nor have they been considered in terms of their effects on retail water prices or demand.

This information is important in evaluating environmental consequences because potential impacts on population, economic growth, and employment depend on the net benefit, not the gross benefit, of the alternatives. If the costs of CALFED supplies were substantially less than other supply options, the CALFED alternatives could have small positive effects on economic growth. If the costs of CALFED supplies were much more than other options, increased retail water costs could have small negative effects on economic growth and employment. Currently, it is believed that the costs of CALFED options will be similar to the costs of other supplies avoided. Therefore, no significant effects on economic growth, population, or employment, and no significant effects on the related natural and physical environment are anticipated.

Impacts on water quality are analyzed only for total dissolved solids (TDS). Impacts are analyzed only for Alternatives 1A, 1B, 1C, 2A, 2B, 2D, 2E and 3E; and only for the service areas of Contra Costa Water District (CCWD) and Metropolitan Water District of Southern California (Metropolitan). The analysis accounts only for differences in the quality of Delta source water caused by differences in Delta intake and conveyance configurations, and the economic analysis will account for blending of different Delta water deliveries with Colorado River water in Metropolitan. Differences in quality of source water caused by differences in export and storage amounts and in timing are not considered. Metropolitan accounts for about 60 percent of M&I water demands included in the analysis.

Results suggest that source water quality for CCWD will be improved by all variations of Alternative 2 except Alternative 2C. (Alternative 2C was not analyzed.) However, water quality is often in a range not considered to be economically important; therefore, water quality improvements would be economically significant only in some years.

Results for Metropolitan suggest that source water quality will be improved by all variations of Alternative 2 (except Alternative 2C) and by Alternative 3E. Alternative 2C and the other variations of Alternative 3 were not analyzed. Metropolitan also obtains improved water quality for end users because of significantly increased Delta water supplies in Alternative 1C, 2B, 2E, and all of Alternative 3—except for Alternatives 3A and 3C. Economic analysis was not available for this draft, but improved end-user quality due to more and better quality source water should be economically significant in Alternatives 3E, 2E, and 2B, and possibly in additional alternatives.

Based on the limited information available at this time, the economic consequences of all common programs are not believed to be significant for any alternative.

Region	Existing Conditions	No Action	Alternatives																
			Alt 1			Alt 2					Alt 3								
			1a	1b	1c	2a	2b	2c	2d	2e	3a	3b	3c	3d	3e	3f	3g	3h	3i
Delta					S		S			S		S		S	S	S	S	S	S
Bay					S		S			S		S		S	S	S	S	S	S
Sacramento River					S		S			S		S		S	S	S	S	S	S
San Joaquin River					S		S			S		S		S	S	S	S	S	S
Other SWP Service Areas					S		S,Q			S,Q		S		S	S,Q	S	S	S	S

NOTES:

Any symbol means that a significant effect has been identified. S = Water supply benefit, C = Water supply cost, Q = Water quality benefit.

The lack of a symbol does not mean that the alternative will not have significant impacts. Rather, it means that no decision has been reached, or information is not available.

Table 1. Significant Impacts by Region and Source, M&I Water Supply Economics

C-002596

3.0 Assessment Methods

M&I water supply economics assessment variables include:

- Water supply benefits and costs,
- Water quality benefits, and
- Conservation benefits and costs.

3.1 Water Supply

The M&I water supply economics assessment uses preliminary results from DWRSIM and a model of M&I water supply economics to calculate the gross benefits of new CALFED water supplies. No information on costs of CALFED alternatives is developed or used in the analysis; therefore, no judgment can be made about the potential benefit-cost relations of the alternatives.

Water supply benefits are any cost savings on water supplies acquired to meet future demands and make-up supplies acquired for use during drought. If total end-user deliveries are reduced during drought, shortage occurs. Net revenue losses, shortage management costs, and end-user shortage costs are also considered as costs avoided by having new supplies during drought. The analysis includes average condition and critical condition water deliveries and economics; therefore, the benefits in the average hydrologic condition are only water supply costs avoided, but avoided costs in the critical condition also include the end-user shortage costs.

The M&I water supply economics model is operated in a limited way because no information on costs of the CALFED water supply options is currently available. Normally, the average-condition model operates to pass on costs and cost savings of water supply options to consumers in the form of water prices, and water prices affect demand. If CALFED alternatives were to provide water at a lower cost than other options, water price would be reduced and demand would increase. In this analysis, retail water prices are fixed at No Action levels so that the level of demand does not vary as a result of CALFED alternatives, and the measure of benefit is the cost savings from avoided costs only.

In the critical condition, economic costs involve supply cost savings and shortage costs. The analysis requires mandatory drought conservation up to a maximum before new supplies can be purchased in the critical condition. End-user shortage costs are calculated from economic demand functions tailored to each group of providers in the analysis. If mandatory conservation is not sufficient to accommodate the supply deficit, make-up supplies must be developed. Make-up supplies developed for use during the critical condition are generally more expensive than supplies for use in the average condition.

The analysis uses functions that describe the yields and costs of supplies replaced by the CALFED water supplies. The critical period yield of these supplies is assumed to be 50 percent of their average condition yield. Therefore, CALFED supplies in the critical period must provide more than 50 percent of their average yield to result in a net critical period supply increase.

Several other important assumptions of the M&I economic analysis are:

- No water transfers from the central valley are allowed as alternative supplies.
- Some other potential water supply options are not allowed as alternative supplies.
- Water demands are based on DWR's Bulletin 160-93 2020 levels.

These three factors tend to increase the value of new water significantly relative to existing and actual future conditions because (1) water transfers have recently been, and should continue to be, a low-cost source of supplies; (2) some other water supplies will become feasible and cost-effective, and some may be developed between now and 2020; and (3) more water demands increase the marginal (incremental) cost of supplies used.

For this preliminary impact assessment, the Central Valley Project Improvement Act (CVPIA) Programmatic EIS (PEIS) Alternative 1 hydrology is used to represent the CALFED No Action Alternative. The PEIS Alternative 1 includes restoration payments, 800,000 acre-feet (AF) of CVP yield dedicated for fish and wildlife, B2 water management, and the Shasta temperature control device. All of these actions are also included in the CALFED No Action Alternative.

The PEIS Alternative 1 has some differences, however, from the CALFED No Action Alternative. First, PEIS Alternative 1 includes Level 2 refuge water supplies, while the CALFED No Action Alternative requires more water to meet Level 4 supplies. Second, The PEIS Alternative 1 includes Trinity River fisheries restoration actions that reduce diversions from the Trinity basin; therefore, PEIS Alternative 1 supplies are reduced relative to the CALFED No Action Alternative. Third, the PEIS Alternative 1 includes retirement of 30,000 acres of San Joaquin Basin lands that is not included in the CALFED No Action Alternative. Some water is therefore available in the PEIS Alternative 1 that is not available in the CALFED No Action Alternative. All else equal, the PEIS Alternative 1 should be roughly representative of the CALFED No Action Alternative, but with slightly more water available.

In the M&I analysis, PEIS Alternative 1 M&I deliveries are the baseline; increases in deliveries caused by the CALFED alternatives as estimated by DWRSIM are added to the baseline levels. The DWRSIM preliminary runs used in the analysis, the corresponding alternatives, and the increase in critical and average M&I deliveries are shown below.

DWRSIM Run No.	CALFED Alternatives	TAF/Yr Increase in M&I Deliveries	
		Average	Critical
472	No Action, 1A, 1B	0	0
472B	2A, 2C	60	26
475	3A, 3C	90	69
498	2D	107	122
510	1C, 2B, 2E	185	235
500	3B, 3D through 3I	220	353

These M&I deliveries are equal to one-third of the total increase in deliveries. The other two-thirds were allocated to agricultural and environmental uses.

The total increase in M&I deliveries was allocated to all CVP and SWP M&I users in the analysis according to their share of total contract or entitlement. The contract or entitlement amounts and shares are shown below.

M&I Provider Group	TAF Contract or Entitlement	Share of CALFED Water (%)
CVP Shasta	37	1
CVP Sacramento	76	2
CCWD	167	5
CVP San Felipe	128	4
SWP North Bay	67	2
SWP South Bay	188	6
CVP San Joaquin	29	1
SWP San Joaquin	143	4
SWP Coastal Aqueduct	50	2
SWP South of Kern County	2,468	74

3.2 Water Quality

Water quality constituents that are important to M&I water users include salinity and related by-products, organic carbon and related by-products, turbidity, and microbes. Water quality of M&I supplies may be affected by the quality of source waters, but changes in quantities of supplies are also important when a provider uses numerous supplies that vary in their quality. Some providers intentionally mix supplies of various qualities to obtain water quality goals.

Because water quality is affected by the actions of all water users, M&I water users are affected by water quality actions targeted to non-M&I water users. M&I water users also may pay some of the costs of water quality actions even if the actions are targeted to non-M&I water users, and M&I water users may pay water quality costs for actions that do not improve M&I water quality in an economically meaningful way. The exact scope of water quality actions and the financing of the actions in terms of cost shares have not yet been determined; therefore, a comprehensive analysis of costs and benefits is not possible.

This technical report will include an economic analysis of salinity damages in Metropolitan's service area for some CALFED alternatives. Water quality of Delta water exports for use in Metropolitan is strongly affected by the configuration of Delta conveyance and export facilities. Also, salinity of water delivered in Metropolitan's service area can be improved with more

Delta water supplies because Delta water is blended with other, more saline supplies.

DWRSIM results are used to estimate Delta water supplies for CALFED alternatives. DWRSIM Run 472 provides deliveries to Metropolitan for the CALFED No Action condition. To obtain deliveries for the other alternatives, the differences in total average delivery between Run 472 and the alternatives runs were calculated, and these differences were allocated to water users according to their share of CVP contracts plus SWP entitlements. By this formula, Metropolitan receives 60 percent of any incremental M&I water yield, or about 20 percent of all CALFED yield, that results from the CALFED alternatives. This yield increment is added to the No Action Metropolitan delivery from DWRSIM Run 472. Results are provided in Table 2 below.

DWR provided estimates of end-of-month salinity at Clifton Court Forebay for the water years 1976 to 1991 for Alternatives 1A, 1C, 2B, 2D, 2E, and 3E. Alternative 1A salinity is believed to be representative for Alternative 1B, and Alternative 2B salinity is believed to be representative for Alternative 2A. Salinity results for Alternative 3A are forthcoming, and these runs should be representative for Alternatives 3B through 3D as well. All of these results are based on DWRSIM Run 472B hydrology, so monthly data on SWP exports under Run 472B hydrology at Banks Pumping Plant were obtained. Monthly salinities were multiplied by monthly exports, and the products were summed and divided by total delivery over the period to obtain flow-weighted salinity. Results are provided in Table 2 below.

In total, analysis is possible for Alternatives 1A, 1B, 1C, 2A, 2B, 2D, 2E, and 3E. Because deliveries and salinities for Alternatives 1A and 1B are identical, seven analyses are possible.

The salinity data account only for differences in salinity caused by the different geometry of Delta conveyance and intake configurations. Since the salinity data are all estimated from Run 472B hydrology, they do not account for any differences caused by different export amounts or storage configurations, or the timing of exports or storage releases. Therefore, economic results account for only part of the impacts of the alternatives on salinity and salinity damages. Unfortunately, it is not known whether salinity damages would be more or less if storage and export amounts and timing were accounted for.

Water quality costs of these changes in water supply and its salinity will be estimated using an economic model of salinity costs. The model is based on an earlier model of salinity damages for the entire lower Colorado River basin as discussed in *Estimating Economic Impacts of Salinity of the Colorado River* (Milliken Chapman Research Group, 1998).

3.3 Water Conservation

M&I providers are affected by the water conservation actions of others. They may finance other's water conservation actions, and others may participate in M&I water conservation in many ways. The CALFED Bay-Delta Program Water Use Efficiency Input Report 5-1 provides general and specific state-wide assumptions, estimates of urban water use, and preliminary estimates of existing and future urban water conservation efforts with and without the

Alternative	DWRSIM Run #	MWD Delivery	Clifton Court TDS[a]
No Action	472	1,597	269.02
1A, 1B	472	1,597	269.02
1C	510	1,707	281.43
2A	472B	1,632	180.55
2B	510	1,707	180.55
2C	472B	1,632	None available
2D	498	1,661	181.86
2	510	1,707	177.75
3A, 3C	475	1,650	Forthcoming
3B, 3D	500	1,727	Forthcoming
3E	500	1,727	125.95
3F through 3I	500	1,727	None available

NOTE:

MWD = Metropolitan Water District of Southern California.

[a] All TDS estimates assume DWRSIM Run 472B hydrology.

Table 2. Metropolitan Delivery and Salinity Estimates Used for Salinity Damages Analysis

CALFED water conservation common program on a regional basis. Costs of these measures are forthcoming.

Water conservation benefits are primarily water cost savings that depend on supply levels, and economic savings may also include end-user energy cost and wastewater treatment cost savings. Conservation costs include program costs and end-user costs. Utilities pay the program costs of conservation programs. End-users pay some additional costs for compliance with mandatory and voluntary provisions (e.g., costs of water-saving devices, time, and inconvenience).

The assessment of M&I water conservation economics is qualitative because quantitative information on the costs of water conservation is not available. Future impact analysis will consider quantitative information on these variables. Costs will be provided, and techniques will be developed to estimate benefits associated with water conservation.

3.4 Relationships with M&I Land Use

This technical report is not concerned with M&I land use as it may be directly affected by the alternatives (e.g., if habitat restoration were to involve urban land acquisition). The land use impact analysis identifies some potential direct M&I land use changes that may affect M&I water demands and economics, but the specific locations of land use changes cannot be identified until Phase III of the CALFED process.

4.0 Significance Criteria

The California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) define slightly different roles for economics. Under CEQA, economic changes are categorically not subject to significance calls. However, economic impacts may be used to determine that a physical change is significant, and if economic changes result in physical or environmental effects, these physical effects may be judged to be significant (Bass et al., 1996). Therefore, economic effects must be considered only if they may have an environmental effect, and they may be considered as a measure by which physical effects can be judged.

Under NEPA, economic effects do not require preparation of an EIS, but economic effects related to natural or physical environmental effects must be discussed when an EIS is prepared. Apparently, CEQA allows economic results to be used as a measure of impact, but NEPA requires that these economic results of a physical change be discussed.

A list of economic and demographic factors that have been considered in environmental documentation has been compiled by CALFED (1996) for use in this effort. Particular economic and demographic considerations of potential relevance to M&I water supply economics include:

- Changes in population or population inducement by a water supply project,
- Changes in housing,
- Impacts to employment income or loss of full-time equivalent jobs, and
- Costs of options displaced and expected economic losses.

The economic analysis does not measure any of these variables; consequently, none of them are used in the impact analysis. Water supply does not induce growth in the economic model. Rather, water supply replaces other supplies and cost savings affect price, which affects conservation by existing users. Also, water supplies affect the magnitude and cost of end-user shortage during drought. If price and drought shortage is substantially affected, potential impacts on economic growth, population, and housing must be assessed qualitatively.

NEPA requires a discussion of economic effects, and some CALFED actions will have both economic benefits and costs. An economic impact might be considered adverse if its costs are expected to be larger than its benefits, and an impact might be considered beneficial if its benefits exceed its costs. Because information on the costs of CALFED alternatives is not currently available, an indication of whether a net impact is adverse or beneficial (based on the relative size of costs and benefits) is not possible at this time. Deeming an impact beneficial and significant based on water supply means that the water supply is beneficial in terms of the costs of other supplies and shortage costs avoided. It does not imply that the net benefit is positive (i.e., that benefits exceed costs).

5.0 Environmental Impacts

5.1 Description of No Action Resource Conditions

The No Action Alternative is the baseline against which alternatives are compared for purposes of evaluating significance. The No Action Alternative displays the state of water supply economics under a 2020 level of development. The 2020 level of development is especially important to M&I water supply economics because of the increase in population and urban water use over time. Economic growth, and increasing population and municipal water demands, are part of the No Action and Action Alternatives. Population and economic growth increase the use of local supplies, contracts, and entitlements, leaving less water available for other users and for use in following years. If growth causes M&I water demand to exceed available supplies, more conservation or new supplies are required. Increased demand in the future would mean that shortages during drought will be more frequent and severe compared to existing conditions. All else equal, larger percent cutbacks in deliveries must be imposed early, or larger shortages as a percent of use must occur later in the drought.

The No Action Alternative includes a number of projects that will reduce Delta export constraints, as discussed under each region below. Under existing conditions, there are times when Delta conveyance or pumping capacity limits exports. At other times, water is available in the Delta and excess pumping capacity is available, but no immediate demand or storage space is available to utilize the water. New south-of-Delta storage and conveyance projects increase the frequency and duration of time in which Delta export constraints are the limiting factor, and the potential yield and value from Delta improvements to reduce export constraints increases with additional storage and conveyance south of the Delta.

Improvements that reduce Delta constraints increase the feasibility and reduce the costs of water transfers from willing sellers, and additional conveyance and storage south-of-Delta increase the importance of Delta constraints as the factor that limits transfers. Increased availability of transfers from specific places in specific times will reduce average transfer costs, increase the use of transfers, and reduce the use of other more expensive supplies. This analysis does not include a quantitative assessment of CALFED alternatives in relation to water transfers.

Table 3 shows characteristics of M&I provider groups for the existing condition and the No Action Alternative.

5.1.1 Delta Region

Delta M&I providers include the cities of Pittsburg, Antioch, Tracy, Brentwood, and Isleton; small parts of the Sacramento and Stockton metropolitan areas; some industrial users; and a number of small communities and residential users in the Delta. CCWD provides water to Pittsburg, Antioch, and Oakley Water District and has agreed to provide M&I water service in the future within East Contra Costa Irrigation District and the City of Brentwood. CCWD and Tracy receive their water from the CVP.

More details on the Delta Region are provided in the Affected Environment Technical Report. For purposes of preliminary impact analysis of water supply

Condition Variable	Delta Region (CCWD)[a]	Sacramento River Region	Bay Region (not CCWD)	San Joaquin Region	Other SWP Service Areas
Existing Condition					
TAF average demand	150	566	707	337	3,784
TAF dry year demand	150	613	767	344	3,916
Typical retail cost, $/Af[b]	$700	$100-300	$500-650	$250-350	$450-1,350
Typical retail price, $/AF	$450	$0-300	$350-500	$100-150	$350-1,250
Percent industrial and commercial	31%	41%	31%	48%	26%
No Action Alternative					
TAF average demand	175	925	864	701	5,817
TAF dry year demand	178	1,003	960	710	6,032
Typical retail cost, $/Af[b]	$806	$125-325	$575-700	$275-350	$500-1,450
Typical retail price, $/AF	$502	$0-250	$400-600	$125-175	$420-1,350
Percent industrial and commercial	31%	41%	31%	48%	26%
Average cost of supplies[c]	$523	$115	$152	$207	$702
TAF shortage during drought	28	12	251	47	1,511
Mandatory conservation during drought	10	12	54	33	571
Average loss per AF from mandatory conservation[d]	$549	$192	$451	$195	$523
TAF supplies developed during drought	18	0	195	14	940
Average cost of drought supplies, $/AF	$876		$904	$140	$729

[a] Includes major industrial direct diversions of 10,000 AF/yr.

[b] Average cost for residential customers including service charges. Costs and prices for providers with only CVP water are typically higher.

[c] Average cost of supplies avoided or saved (Bay Area) to achieve supply/demand balance in No Action.

[d] Net revenue loss plus consumer surplus loss.

Table 3. Characteristics of M&I Provider Regions for Existing Condition and No Action Alternative

changes, economic impacts in CCWD are used to represent economic impacts of the alternatives in the Delta Region. The major reason for this assumption is that other M&I water supplies for most other providers in the Delta, for providers in Sacramento and Stockton, and for numerous small providers will not be affected by the alternatives in ways that can be measured at this time. In the following discussion, the term "Delta providers" is reserved for any and all providers actually located within the statutory Delta.

Table 3 shows some characteristics of CCWD in the existing and No Action conditions. Current demand is about 150,000 AF, which includes 10,000 AF of direct diversions by industrial customers. Retail cost to residential customers is currently about $700 per AF; and price, which does not include service charges, is about $450. About one-third of demands are commercial and industrial. Demand is expected to rise to 175,000 AF by 2020, with slightly higher demands in dry years due to less recharge of urban landscapes.

The No Action Alternative retail cost and price are higher than existing conditions because of conservation, CVPIA costs, and costs of new supplies. The average cost of new supplies from the M&I analysis needed to bring supply up to demand in the average condition is $523 per AF delivered. The average condition supply deficit is about 4,600 AF.

During the critical period, 2020 demand exceeds supply by 28,000 AF on average. Mandatory conservation is used to eliminate 10,000 AF of shortage, and supplies are acquired to eliminate the remaining 18,000 AF. Mandatory conservation costs $549 per AF in lost net revenue and consumer surplus, and the make-up supplies cost $876 per AF delivered. Water transfers, which would reduce supply costs, are not available as a supply option in the average or critical year.

No Action projects that may reduce M&I supplies or increase costs relative to existing conditions include:

CVPIA: The CALFED No Action Alternative includes dedication of 800,000 AF of water for fish and wildlife, Level IV refuge water, restoration payments, and operation of the Shasta temperature control device. The dedicated water and Level IV refuge supplies will reduce CCWD water supplies relative to existing conditions. The CVPIA also will affect other providers located within the statutory Delta, including the City of Tracy, and potentially parts of Stockton and Sacramento.

No Action Alternative projects that are expected to increase supplies or reduce future costs, once completed, include:

Los Vaqueros Reservoir Project: This project will improve the quality and reliability of CCWD M&I supplies.

Other Delta providers (not CCWD) are generally provided by larger water wholesalers, small districts, or individual wells. No specific actions have been identified that will affect them. However, these small providers may have plans and programs in place that will affect their future water supplies.

5.1.2 Bay Region

The Bay Region includes the service areas of the San Felipe Unit of the CVP, and the South Bay and North Bay aqueducts of the SWP. In addition, the service area of the Hetch-Hetchy Aqueduct is included because of potential interactions with the South Bay

Aqueduct. East Bay Municipal Utility District (EBMUD) is not included because the District does not currently receive CVP or SWP water, and the District does not divert water from the Delta. There are no specific plans to acquire Mokelumne River water as part of CALFED alternatives; however, EBMUD can be included should this occur.

The North Bay consists of SWP entitlement holders served by the North Bay Aqueduct (NBA) of the SWP and others who have used or could use this facility in exchanges. The cities of Vallejo, Vacaville, Fairfield, Benicia, and Suisun are included. Three SWP entitlement holders—Alameda County Water District, Alameda County Zone 7, and the Santa Clara Valley Water District (SCVWD)—are located in the South Bay. SCVWD is also served by the San Felipe Unit of the CVP and wholesales water in a large part of the south San Francisco Bay.

Table 3 shows some characteristics of the Bay Region in the existing and No Action conditions. Current demand is about 707,000 AF. Retail cost to residential customers is currently about $500 to $650 per AF; and price, which does not include service charges, is $350 to $500 per AF. About one-third of demands are commercial and industrial.

Demand is expected to rise to 864,000 AF by 2020, with slightly higher demands in dry years due to less recharge of urban landscapes. The No Action Alternative cost and price are higher than for existing conditions because of conservation, CVPIA costs, and costs of new supplies. The region has an overall supply surplus in the average condition, and the average cost avoided by not needing these supplies is $152 per AF delivered.

During the critical period, 2020 demand exceeds supply by 251,000 AF on average. Mandatory conservation is used to eliminate 54,000 AF of shortage, and supplies are acquired to eliminate the remaining 195,000 AF. Mandatory conservation costs $451 per AF in lost net revenue and consumer surplus, and the additional supplies cost $904 per AF. Water transfers are not available as a supply option in the average or critical year.

This region is affected by any actions that affect the SWP or the CVP. No Action projects that may reduce M&I supplies or increase costs relative to existing conditions include:

> The CVPIA may reduce CVP supplies and increase costs, for reasons described above.

No Action Alternative projects that are expected to increase supplies or reduce future costs, once completed, include:

> The CVPIA may increase SWP supplies, depending on the amount of dedicated water that can be exported from the Delta.

5.1.3 Sacramento River Region

This region includes all M&I use in the Sacramento Valley served by the CVP. Almost all of this water use occurs in the Sacramento metropolitan area and near Redding. More detail is provided in the Affected Environment Technical Report.

Table 3 shows some characteristics of the Sacramento River Region in the existing and No Action conditions. Current demand is about 566,000 AF. Retail cost to residential customers is currently about $100 to $300 per AF; and price, which does not include service charges, is $0 to $300 per AF. Price is zero in some areas because some use is not metered or priced. About 40 percent of demands are commercial and industrial.

Demand is expected to rise to 925,000 AF by 2020, with higher demands in dry years due to less recharge of urban landscapes. The No Action Alternative cost and price are higher than for existing conditions because of conservation and CVPIA costs. The marginal cost of supplies is $115 per AF delivered. During the critical period, 2020 demand exceeds supply by 12,000 AF, on average. Mandatory conservation can be used to eliminate the entire shortage, and mandatory conservation costs $192 per AF in lost net revenue and consumer surplus.

No Action projects that may reduce M&I supplies or increase costs relative to existing conditions include:

The CVPIA may reduce CVP supplies and increase costs, for reasons described above.

Interim re-operation of Folsom Reservoir: This project could reduce M&I water supplies in the Sacramento area by dedicating more storage space to flood control.

5.1.4 San Joaquin River Region

The San Joaquin River Region includes only those M&I providers in the San Joaquin Valley with some current use or planned use of CVP or SWP supplies exported from the Delta. CVP water service contracts in the region are served by the Delta-Mendota and San Luis canals; Stockton East is included in this group, with a CVP contract of 38,000 AF delivered from New Melones Reservoir. The next largest CVP M&I water users are Westlands Water District, Tracy, Avenal, Coalinga, and Huron; but small amounts of M&I water are taken by a number of other districts. M&I water use in the Friant Division of the CVP is included even though it may not be affected by CALFED actions. SWP entitlements are served via the California Aqueduct. The City of Bakersfield obtains SWP M&I supplies through Kern County Water Agency (KCWA).

Table 3 shows some characteristics of the San Joaquin River Region group in the existing and No Action conditions. Current demand is about 337,000 AF. Retail cost to residential customers is currently about $250 to $350 per AF; and price, which does not include service charges, is $100 to $150 per AF. About half the demands are commercial and industrial.

Demand is expected to double to 701,000 AF by 2020, with higher demands in dry years due to less recharge of urban landscapes. The No Action Alternative cost and price are higher than for existing conditions because of conservation and CVPIA costs. The marginal cost cf supplies is $207 per AF delivered. During the critical period, 2020 demand exceeds supply by 47,000 AF on average. Mandatory conservation can be used to eliminate 33,000 AF of shortage, and mandatory conservation costs $195 per AF in lost net revenue and consumer surplus. More groundwater is extracted to eliminate the remaining shortage at a cost of $140 per AF delivered.

No Action projects that may reduce M&I supplies or increase costs relative to existing conditions include:

The CVPIA may reduce CVP supplies and increase costs, for reasons described above.

No Action projects that are expected to increase supplies or reduce future costs, once completed, include:

Monterey Agreement: This project revises the formula used to allocate SWP water, retires 45,000 AF of agricultural entitlement, transfers 130,000 AF of entitlement from agriculture to M&I, allows sale of the Kern Fan element of the Kern Water Bank to agricultural contractors, and changes allowable operations at Castaic Lake and Lake Perris.

The CVPIA may increase SWP supplies, for reasons described above.

New Melones Conveyance Project: This project conveys water to Stockton East Water District and Central San Joaquin Water Conservation District for use near and within Stockton.

5.1.5 Other SWP Service Areas

This region includes the service areas of all SWP entitlement holders south of Kern County. The single largest provider is Metropolitan in DWR's South Coast Region. The South Coast M&I water demand exceeds the demands of all other M&I regions combined. The region includes Ventura, Los Angeles, and Orange counties; and the western portions of San Diego, Riverside, and San Bernardino counties.The region also includes service areas receiving SWP water in DWR's Central Coast Region, the Antelope Valley and Mojave River planning subareas of the South Lahontan Region, and the Coachella planning subarea of the Colorado River Region.

Table 3 shows some characteristics of the Other SWP Service Areas in the existing and No Action conditions. Current demand is about 3,784,000 AF in average years. Retail cost to residential customers is currently about $450 to $1,350 per AF. The higher price is representative of the Central Coast area only. Price, which does not include service charges, is about $350 to $1,250 per AF. About one-quarter of the demands are commercial and industrial.

Demand would rise to 6,025,000 AF by 2020, but the costs of new supplies required to meet 2020 demand increases water price, and 2020 demand is reduced to 5,817,000 in average years. Demands are higher in dry years due to less recharge of urban landscapes. The No Action Alternative cost and price are higher than for existing conditions because of conservation and costs of new supplies. The average cost of new supplies needed to eliminate a 2020 supply deficit of over 1 million AF (MAF) is about $702 per AF, but the marginal (incremental) cost is more than $1,000 per AF because of the large amount of water involved. Water transfers from the Central Valley are not allowed as a means of meeting this demand.

During the critical period, 2020 demand exceeds supply by 1,511,000 AF, on average. Mandatory conservation is used to eliminate 571,000 AF of shortage, and supplies are acquired to eliminate the remaining 940,000 AF. Mandatory conservation costs $523 per AF in lost net revenue and consumer surplus, and the additional supplies cost $729 per AF. Additional water transfers are not available as a supply option in the critical year.

No Action projects that are expected to increase supplies or reduce future costs, once completed, include:

The CVPIA may increase SWP supplies, for reasons described above.

Coastal Aqueduct: This project will provide SWP water for M&I use in San Luis Obispo and Santa Barbara counties.

The Monterey Agreement will change SWP water allocations for M&I use, for the reasons described above.

Kern Water Bank: Only those aspects currently completed and operated are included in this analysis. The Kern Water Bank will develop storage capacity to augment the SWP's dependable supply.

Metropolitan's Eastside Reservoir Project: This project will provide emergency storage following earthquake, supplies during drought, and supplies to meet peak summer demands.

Semitropic Water Storage District (WSD) Groundwater Banking Project: This project allows Metropolitan to recharge and extract SWP water in the Semitropic WSD, and will reduce overdraft and increase operational flexibility.

5.2 Description of Alternative Resource Conditions

5.2.1 Delta Region

Table 4 provides a summary of the impact analysis for the Delta Region. CCWD is used as a proxy for water supply and quality analysis. It should be kept in mind that not all of CCWD is in the statutory Delta, and some M&I providers in the Delta are not served by CCWD. Water supply and water quality analysis are applied only to CCWD; but other comments, especially those with respect to the CALFED common programs, apply to all Delta providers.

Alternative 1

This alternative would utilize the existing system of through-Delta conveyance with some small physical modifications. Three variations of this alternative all include the CALFED common programs.

Environmental water would be acquired from willing sellers, habitat restoration would be located in the northern and western Delta, and relocation of water supply intakes for water quality purposes would be evaluated. Precise locations for many actions are not currently known, and names of locations are provided below for example purposes only.

Ecosystem Restoration Program

Ecosystem restoration actions include habitat restoration, changes in environmental water flows, development of floodways and meander zones, fish passage and fish screen improvements, undesirable species management, and water quality improvements. These actions are expected to have small or no effects on M&I water supplies and costs unless environmental flows reduce M&I supplies or M&I providers pay some of the costs of restoration. Water flows for fish and wildlife could increase M&I water supply if the water can be reused as M&I water exports or if the flows contribute to Delta water quality standards. Prices of water transfers may be increased by transfers for environmental purposes.

Some restoration actions may have beneficial effects on water quality in the Delta. Water quality improvements may occur through dilution caused by increased Delta inflow for restoration purposes,

Economic Parameter	Impacts by Alternative (millions of dollars per year)[a]																		
	Existing Conditions[b]	No Action[c]	Alternative 1[c]			Alternative 2[c]					Alternative 3[c]								
			1a	1b	1c	2a	2b	2c	2d	2e	3a	3b	3c	3d	3e	3f	3g	3h	3i
CALFED water supply costs[d]	0	0	No costs available																
Other water supply costs[d]	0	1.3	1.3	1.3	-3.2	0	-3.2	0	-1.4	-3.2	0	-3.9	0	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Total average costs[d]																			
Drought conservation costs[d]	5	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
Drought make-up supply costs	0	15.4	15.4	15.4	8.4	15.4	8.4	15.4	11.9	8.4	13.2	4.1	13.2	4.1	4.1	4.1	4.1	4.1	4.1
Total drought cost[e].	5	21.1	21.1	21.1	14.1	21.1	14.1	21.1	17.6	14.1	18.9	9.8	18.9	9.8	9.8	9.8	9.8	9.8	9.8
Water quality costs[f]						S	S		S	S									
Water conservation costs																			

NOTE:

CCWD impacts are used for water cost and water quality analysis.

[a] The lack of an entry does not mean that the impact is less than significant.

[b] Negative dollars in average years are cost savings from not needing available supplies.

[c] Under the 2020 development condition. Costs are additional costs to develop supplies or cost savings (-) from not needing available supplies.

[d] During a year of average delivery.

[e] During a year of the critical period (1928-1934). Assumes supplies are allocated evenly over the period.

[f] See text. Significance calls relate only to differences in the configuration of Delta intake and conveyance facilities. A "B" denotes a probable beneficial effect, an "S" denotes a probable benefit in some years.

Table 4. Summary of Impact Analysis for Delta Region

through reduced pollution loads caused by development and restoration of marsh and riparian habitats, and by increased immobilization of pollutants in these habitat types.

Restoration may reduce the uncertainty of M&I water supplies by enhancing recovery of special- status species. Because M&I providers acquire water supplies to protect against uncertainty, water supply costs could be reduced.

Water Quality

The Water Quality Common Program includes source control, treatment, management, and other actions to reduce releases and costs of pollutants in the Bay-Delta system. The Water Quality Common Program would utilize six programmatic actions to improve water quality in the Bay-Delta system. These actions are explained in more detail in the Water Quality Impacts Technical Report. The six actions are:

- Action 1. Reduce heavy metal emissions by source control and treatment of mine drainage.

  The principal mines are the Penn and Newton mines in the Mokelumne River watershed, and other sources are located in the Cosumnes River and Yolo Bypass watersheds. Costs would be incurred for sealing mines, removing and capping tailings piles, diverting streams, and removing contaminated stream bed sediments. It is expected that metals emissions will be reduced by 25 to 30 percent.

- Action 2. Reduce emissions of contaminants in urban and industrial runoff by enforcement of existing regulations and provision of incentives.

  This action would create economic costs through more vigorous enforcement of stormwater management plans. Costs include enforcement and compliance costs. The Water Quality Impacts Technical Report assumes that mass emissions from already built urban and industrial areas could be reduced by 5 percent, and emissions from future developed areas by 20 percent for a rough average of 10 percent. This action could affect all M&I providers in the Delta, including areas served by CCWD, Tracy, and parts of Stockton and Sacramento. Costs are not expected to be significant.

- Action 3. Reduce emissions of contaminants from wastewater treatment plant discharges by enforcement of existing regulations and provision of incentives.

  This action would require costs for more vigorous enforcement of existing regulation involving wastewater discharge, especially effluent limits and pretreatment requirements, and provision of incentives to encourage reductions in pollutant discharge. This action could affect all M&I providers in the Delta, including areas served by CCWD, Tracy, and parts of Stockton and Sacramento. Costs are not expected to be significant.

- Action 4. Reduce emissions of contaminants in agricultural surface runoff.

  This action would affect agricultural economics and land use; therefore, it is not discussed here.

- Action 5. Reduce emissions of contaminants in agricultural subsurface drainage.

  This action would affect agricultural economics and land use; therefore, it is not discussed here.

- Action 6. Relocate diversions to improve water supply quality.

  It is currently unclear how this action would be applied to M&I diverters.

These six actions would have minor benefits for M&I providers and their water customers with some offsetting costs. M&I costs are the M&I cost shares of the water quality measures. M&I providers or their customers would pay some of the costs of source control, stormwater and wastewater management, pretreatment measures, provisions of incentives, and relocation of diversions. Presently, the amount of these costs and the cost shares are unclear.

Most benefits of the Water Quality Common Program will be in the form of avoided treatment and regulatory costs, and avoided end-user costs. Water treatment costs, or costs of mixing Delta water with other supplies, might be reduced. The amount of cost savings will depend substantially on state and federal drinking water standards, especially with respect to metals, disinfection by-products and microbes, and the changing costs and technology of water treatment. Lower salinity will reduce infrastructure damage costs, and net benefits (benefits minus costs) of conjunctive use and water reuse will be increased. End-users might avoid costs of purchased drinking water, tap water treatment, reduced life and value of water-using appliances, and adverse health effects. Currently, no monetary values have been estimated.

Water Use Efficiency

The Water Use Efficiency Program includes policies covering five areas: agricultural water use efficiency, urban water conservation, efficient use of environmental diversions, water recycling, and water transfers. Most actions in the Water Use Efficiency Common Program would be implemented by local agencies rather than CALFED. For M&I providers, the pace of implementation of urban conservation Best Management Practices (BMPs) would accelerate, and new practices would be added. Water reclamation (reuse) would be used to provide a larger share of supply, and policy measures to facilitate transfers would be developed. Overall effects of the Water Use Efficiency Program are considered to be small.

In general, M&I providers would pay the costs of M&I actions; however, only cost-effective measures would be implemented, implying that benefits would be commensurate with costs. Additional benefits include the ability to receive any new water made available by CALFED or the ability to participate in a water transfer that requires approval of a CALFED agency. No general statement about net benefits is possible without consideration of overall supply levels and other factors unique to each provider and alternative.

CALFED Water Use Efficiency Input Report 5-1 describes water conservation baseline levels and goals. Potential savings are described by region, but the Delta Region is not provided as a separate region.

Levee System Integrity

System integrity actions will have minor effects on Delta hydraulics and water quality. Very small effects on water supply and quality and associated costs are expected in normal conditions. In flood conditions or following earthquake, improved levee integrity could affect M&I water quality through the effects of flooding on export operations and water quality. Benefits per event are probably most significant following earthquake, because water quality is less of a concern, on average, during flood events. On average, flood control benefits are limited by the small probability of levee failure event, and this probability will be affected by the Levee System Integrity Program.

Conveyance

Because Alternative 1A would include no additional storage or conveyance, no water supply benefits are expected. The potential impacts of relocating Delta intake structures include minor water quality improvements and cost effects. Preliminary DWRSIM study results suggest using No Action Alternative deliveries for Alternative 1A as well, so there is no measured effect on water supply. Preliminary water quality results are also the same as those provided for the No Action condition.

Alternative 1B would include South Delta modifications to allow export pumps to operate at their physical capacity. Preliminary DWRSIM study results suggest using No Action Alternative deliveries for Alternative 1B as well, so there is no measured effect on water supply. Preliminary water quality results are also the same as those provided for the No Action condition.

Storage

Alternative 1C would build on Alternative 1B by enlarging Delta channels and by adding new water storage facilities. Up to 5 MAF of storage would be added.

The amount and pattern of impacts from Alternative 1C will depend on how the new facilities are managed and operated, and how costs are allocated. New storage facilities may facilitate water transfers. Overall, Alternative 1C should have little effect on water supplies for most Delta M&I providers because most providers do not receive CVP or SWP supplies. Conveyance and storage impacts on Delta M&I providers involve construction and displacement effects, as well as water supply and water quality.

Preliminary DWRSIM modeling studies and assumptions involving the allocation of increased yield imply that CCWD would gain about 9,200 AF in average years and 11,700 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 5 percent and 6.5 percent of demand in average and dry years, respectively. The average year supplies are worth $4.5 million, and the additional supplies in dry years are worth an additional $7.1 million relative to the cost of other supplies.

DWR has provided preliminary analysis of TDS for Alternative 1C (DWR, 1997). The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology. The average of 12 monthly 1976 to 1991 average TDS levels is 294 parts per million (ppm), not significantly different from the 300 ppm for the baseline condition.

Alternative 2

Alternative 2 would utilize a modified system of through-Delta conveyance. Five variations of this configuration are considered that are made up of four conveyance and three storage options. All variations include the Common Programs, slightly modified to complement Alternative 2. Precise locations for many actions are not currently known, and names of locations are provided for example purposes only.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 2A would include the South Delta and CVP/SWP conveyance improve-ements as proposed for Alternative 1C. These measures would increase the diversion capacity of the existing export pumps to full capacity and provide additional operational flexibility. No new storage is included.

Preliminary DWRSIM modeling studies and assumptions involving yield allocation imply that CCWD would gain about 2,500 AF in average years and 1,300 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.4 percent and 0.7 percent of demand in average and dry years, respectively, The average year supplies are worth $1.3 million. The additional supplies in dry years are worth little relative to the cost of other supplies because they are almost 50 percent (1,300/2,500) reliable .

DWR has provided preliminary analysis of TDS for Alternative 2A. The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology. The average of 12 monthly 1976 to 1991 average TDS levels is 166 ppm, almost half of the 300 ppm for the baseline condition. However, No Action salinity levels in many months are below levels generally considered to be economically damaging. Therefore, the difference in water quality due to differences in conveyance and intake configurations alone could be a significant beneficial impact, but only at some times.

Alternative 2C would provide three isolated South Delta conveyance facilities to deliver water to Clifton Court and the Tracy pumps. The three facilities would provide flexibility, depending on need and operating criteria. Also, in-Delta storage would be developed. The Levee System Common Program would be modified to accommodate the new isolated channels.

Preliminary DWRSIM modeling studies for Alternative 2C are the same as those for Alternative 2A; therefore, economic impacts are the same as those discussed for Alternative 2A. Currently, no water quality studies are available.

Storage

Alternative 2B would add up to 5.5 MAF of surface storage and 1 MAF of groundwater storage to Alternative 2A. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C. Preliminary water quality benefits are the same as those discussed for Alternative 2A.

Alternative 2D would use a screened intake in the Sacramento River and a new channel for conveyance. Habitat improvements might be used to provide conveyance and habitat, South Delta modifications might provide new habitat and increase export capacity, and CVP/SWP improvements would improve operating flexibility. Up to 2.0 MAF of storage south of the Delta would be provided.

Preliminary DWRSIM modeling studies and yield allocation assumptions imply that CCWD would gain about 5,300 AF in average years and 6,100 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 3.0 and 3.4 percent of demand in average and dry years, respectively. The average year supplies are worth $2.7 million. The additional supplies in dry years are worth an additional $3.5 million relative to the cost of other supplies.

DWR has provided preliminary analysis of TDS for Alternative 2D. The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology. The average of 12 monthly 1976 to 1991 average TDS levels is 168 ppm, almost half of the 300 ppm for the baseline condition. However, salinity levels in many months are below levels generally considered to be economically damaging. Therefore, the difference in water quality due to differences in conveyance and intake configurations alone could be a significant beneficial impact, but only at some times.

Alternative 2E might develop Tyler Island aquatic habitat and the McCormack Williamson Tract for conveyance. Mokelumne River floodway and East Delta habitat improvements on the South Fork Mokelumne would provide conveyance and habitat, South Delta modifications would provide new habitat and increase export capacity, and CVP/SWP improvements would improve operating flexibility. Up to 5.5 MAF of surface storage and 1 MAF of groundwater storage would be provided. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C.

Preliminary water quality analysis of Alternative 2E is available. The average of 12 monthly 1976 to 1991 average TDS levels is 161 ppm, almost half of the 300 ppm for the baseline condition. However, salinity levels in many months are below levels generally considered to be economically damaging. Therefore, the difference in water quality due to differences in conveyance and intake configurations alone could be a significant beneficial impact, but only at some times.

Alternative 3

This configuration would utilize through-Delta modifications and an isolated system for through-Delta conveyance for exported supplies. Combinations of seven potential conveyance configurations and two new storage configurations result in nine variations. Precise locations for many actions are not currently known, and names of locations are provided for example purposes only.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 3A would modify Alternative 2A by adding a 5,000-cubic-foot-per-second (cfs) isolated open facility, and Delta islands would not be flooded and used for conveyance as in Alternative 2A.

Preliminary DWRSIM modeling studies and yield allocation assumptions imply that CCWD would gain about 2,500 AF in average years and 3,500 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.4 percent and 2.0 percent of demand in average and dry years, respectively. The average year supplies are worth $1.3 million. The additional supplies in dry years are worth an additional $2.3 million relative to the cost of other supplies.

Alternative 3C would replace the open facility of Alternative 3A with a closed pipe. With this change, no additional effects relative to Alternative 3A are expected.

Storage

Alternative 3B would add 5.7 MAF of surface water storage and 1 MAF of groundwater storage to Alternative 3A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that CCWD would gain about 10,800 AF in average years and 17,600 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 6.2 percent and 9.9 percent of demand in average and dry years, respectively. The average year supplies are worth $5.3 million. The additional supplies in dry years are worth $11.4 million relative to the cost of other supplies.

Alternative 3D would replace the open facility of Alternative 3B with a closed pipe. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3E would replace the 5,000-cfs isolated open conveyance facility of Alternative 3B with a 15,000-cfs facility, and the enlargement and barrier at the head of the Old River would be removed. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

DWR has provided preliminary analysis of TDS for Alternative 3E. The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology. The average of 12 monthly 1976 to 1991 average TDS levels is 294 ppm, not significantly different from the 300 ppm for the baseline condition.

Alternative 3F would provide cross-Delta conveyance by the chain of lakes concept. Up to 6.5 MAF of storage would be included. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B, except that a loss of municipal water demand in the Delta would result from the inundation of up to eight islands.

Alternative 3G would locate the 5,000-cfs open isolated conveyance facility in Alternative 3B to the current Sacramento Deep Ship Channel on the west side of the Sacramento River. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3H would modify Alternative 3B by adding habitat on the present Tyler Island, changing the location of other habitat, and reducing in-Delta storage by 200 TAF for a total of 5.5 MAF of storage. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3I would modify Alternative 2C by adding an additional isolated intake (the northern 15,000-cfs isolated Sacramento River intake) and other new storage up to 6.5 MAF. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

5.2.2 Bay Region

Alternative 1

Table 5 provides a summary of the impact analysis for the Bay region. The general description of Alternative 1 and the features of the each sub-alternative provided for the Delta Region is valid for the Bay Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Any water quality improvements would affect the Bay Region through SWP and CVP exports.

Water Quality

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Water quality actions include only two actions:

- Action 2. Reduce emissions of contaminants in urban and industrial runoff by enforcement of existing regulations and provision of incentives.
- Action 3. Reduce emissions of contaminants from wastewater treatment plant discharges by enforcement of existing regulations and provision of incentives.

Water quality in the Bay Region could be affected by the quality of SWP and CVP exports as discussed below.

Water Use Efficiency

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Because the Bay Region generally has a high level of conservation, additional costs of conservation per unit of water saved may be higher than average. CALFED Water Use Efficiency Input Report 5-1 describes preliminary water conservation baseline levels and goals. Potential real water savings from M&I uses due to CALFED Water Use Efficiency Actions for UR-4 (the San

Economic Parameter	Impacts by Alternative (millions of dollars per year)																		
	Existing Conditions	No Action	Alternative 1			Alternative 2					Alternative 3								
			1a	1b	1c	2a	2b	2c	2d	2e	3a	3b	3c	3d	3e	3f	3g	3h	3i
CALFED water supply costs	0	0	No costs available																
Other water supply costs	-14.0	-8.4	-8.4	-8.4	-15.0	-10.6	-15.0	-10.6	-12.3	-15.0	-11.7	-16.1	-11.7	-16.1	-16.1	-16.1	-16.1	-16.1	-16.1
Total average costs																			
Drought conservation costs	42.6	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
Drought make-up supply costs	0	176.6	176.6	176.6	156.9	177.1	156.9	177.1	166.9	156.9	173.1	143.5	173.1	143.5	143.5	143.5	143.5	143.5	143.5
Total drought costs	42.6	202.9	202.9	202.9	183.2	203.4	183.2	203.4	193.2	183.2	199.4	169.8	199.4	169.8	169.8	169.8	169.8	169.8	169.8
Water quality costs						S	S		S	S					B				
Water conservation costs																			

NOTE:
See notes from Table 4.

Table 5. Summary of Impact Analysis for the Bay Region

Francisco Bay Area) are estimated to be 8,000 to 15,000 AF.

Levee System Integrity

The nature and pattern of impacts are as described for Delta Region, Alternative 1. There is little potential impact except as levee failure might affect Delta export operations.

Conveyance

Because Alternative 1A would include no additional storage or conveyance, no water supply benefits are expected. Alternative 1B would include South Delta modifications to allow export pumps to operate at their physical capacity. For Alternatives 1A and 1B, preliminary DWRSIM results suggest there will be no change in water supply and water supply economics, and preliminary water quality analysis is the same as for the No Action condition.

Storage

Alternative 1C would build on Alternative 1B by enlarging Delta channels and by adding new water storage facilities. Up to 5 MAF of storage would be added. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Bay Region would gain about 21,000 AF in average years and 26,900 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 2.4 percent and 2.8 percent of demand in average and dry years, respectively. The average year supplies are worth $6.6 million annually in comparison to the costs of other supplies, and the additional supplies in dry years are worth an additional $19.8 million annually relative to the cost of other supplies.

DWR has provided preliminary analysis of TDS for Alternative 1C. The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology. Results, in terms of average salinity of exports from Clifton Court, are provided in Table 2. There is little difference in salinity between Alternative 1C and No Action. Therefore, any potential economic effects are not significant.

Alternative 2

The general description of Alternative 2 provided for the Delta Region is valid for the Bay Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 2A would include the South Delta and CVP/SWP conveyance improvements as proposed for Alternative 1C. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Bay Region would gain about 6,800 AF in average years and 3,000 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 0.8 percent of demand in average and 0.3 percent in dry years. The average year supplies are worth $2.2 million annually, but the additional CALFED supplies in dry years are worth little ($0.5 million) relative to the supplies they replace.

DWR has provided preliminary analysis of TDS for Alternative 2A. The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology.

Results, in terms of average salinity of exports from Clifton Court, are summarized in Table 2. There is a significant difference in the TDS of exports between Alternative 2A and No Action. However, salinities are generally in a range considered to be economically unimportant for M&I users. At times, Alternative 2A might provide a noticable and economically significant economic improvement. Benefits would involve aesthetics, treatment costs, and, potentially, cost savings from reduced depreciation.

Alternative 2C would provide three isolated South Delta conveyance facilities to deliver water to Clifton Court and the Tracy pumps, and a small amount of in-Delta storage would be developed. Preliminary DWRSIM modeling studies for Alternative 2C are the same as those for Alternative 2A; therefore, economic impacts are the same as those discussed for Alternative 2A. No water quality analysis is available.

Storage

Alternative 2B would add up to 5.5 MAF of surface storage and 1 MAF of groundwater storage to Alternative 2A. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C. Preliminary water quality benefits are the same as those discussed for Allternative 2A.

Alternative 2D would use a screened intake at Hood to divert water from the Sacramento River, a new channel for conveyance, and about 2 MAF of new storage south of the Delta. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Bay Region would gain about 12,100 AF in average years and 13,900 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.4 percent of demand in average and dry years. The average year supplies are worth $3.9 million annually, and the additional supplies in dry years are worth an additional $9.7 million relative to the cost of other supplies. Preliminary water quality analysis of water exported from Clifton Court is summarized in Table 2. Impacts are the same as those discussed for Alternative 2A.

Alternative 2E would develop new conveyance, and up to 5.5 MAF of surface storage and 1 MAF of groundwater storage would be provided. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C. Preliminary water quality analysis of water exported from Clifton Court is summarized in Table 2. Impacts are the same as those discussed for Alternative 2A.

Alternative 3

The general description of Alternative 3 provided for the Delta Region is valid for the Bay Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 3A would modify Alternative 2A by adding a 5,000-cfs isolated open facility, and Delta islands would not be flooded and used for conveyance as in Alternative 2A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Bay Region would gain about 10,200 AF in average years and 7,900 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1 percent of demand in average and dry years. The average year supplies are worth $3.3 million annually, and the additional supplies in dry years are worth an additional $3.5 million relative to the cost of other supplies.

Alternative 3C would replace the open facility of Alternative 3A with a closed pipe. With this change, no additional effects relative to 3A are expected.

Storage

Alternative 3B would add 5.7 MAF of surface water storage and 1 MAF of groundwater storage to Alternative 3A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Bay Region would gain about 24,900 AF in average years and 40,300 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 2.9 percent and 4.2 percent of demand in average and dry years, respectively. The average year supplies are worth $7.7 million annually, and the additional supplies in dry years are worth an additional $33.1 million relative to the cost of other supplies.

Alternative 3D would replace the open facility of Alternative 3B with a closed pipe. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3E would replace the 5,000-cfs isolated open conveyance facility of Alternative 3B with a 15,000-cfs facility, and the enlargement and barrier at the head of the Old River would be removed. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B. Preliminary water quality analysis of water exported from Clifton Court is summarized in Table 2. The concentration of TDS in water exported from Clifton Court would be reduced by over one-half relative to the No Action Alternative. No benefits have been quantified in dollar terms, but this is believed to be a significant benefit for the Bay Area in some years.

Alternative 3F would provide cross-Delta conveyance by the chain of lakes concept. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B, except that conveyance losses might be increased.

Alternative 3G would locate the 5,000-cfs open isolated conveyance facility in Alternative 3B to the current Sacramento Deep Ship Channel on the west side of the Sacramento River. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3H would modify Alternative 3B by changing the amount and location of habitat and reducing in-Delta storage by 200 TAF, for a total of 5.5 MAF of storage. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3I would modify Alternative 2C by adding an additional isolated intake and other new storage up to 6.5 MAF. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

5.2.3 Sacramento River Region

The impact analysis for the Sacramento River region is summarized in Table 6.

Alternative 1

The general description of Alternative 1 and the features of the each sub-alternative provided for the Delta Region is valid for the Sacramento River Region as well.

Ecosystem Restoration Program

The Ecosystem Restoration Program would have no effect on the Sacramento River Region, except as CVP water service contract supply amounts may be affected.

Water Quality

The Water Quality Common Program is the same as described for the Delta Region, Alternative 1, except that Actions 5,6, and 7 are not included. Major mines in the Sacramento River Basin include Iron Mountain Mine, Afterthought Mine, Cherokee Mine, and Manzanita Mine. The Water Quality Program would have no effect on the Sacramento River Region, except as CVP water service contract supply amounts may be affected.

Water Use Efficiency

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Because the Sacramento River Region generally has a low level of conservation, additional costs of conservation per unit of water saved may be lower than average. CALFED Water Use Efficiency Input Report 5-1 describes preliminary water conservation baseline levels and goals. Potential real water savings from M&I uses due to CALFED Water Use Efficiency Actions for UR-1, the Sacramento River Area, are estimated to be 5,000 to 9,000 AF.

Levee System Integrity

The Levee System Integrity Program would have no effect on M&I water supplies in the Sacramento River Region.

Conveyance

Because Alternative 1A would include no additional storage or conveyance, no water supply benefits are expected. Alternative 1B would include South Delta modifications to allow export pumps to operate at their physical capacity. For Alternatives 1A and 1B, preliminary DWRSIM results suggest there will be no change in water supply and water supply economics.

Storage

Alternative 1C would build on Alternative 1B by enlarging Delta channels and by adding new water storage facilities. Up to 5 MAF of storage would be added. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Sacramento River Region would gain about 11,100 AF in average years and 7,900 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.2 percent of demand in average and 0.8 percent of demand in dry years. The average year supplies are worth $1.3 million annually, and the additional supplies in dry years are worth an additional $0.6 million annually relative to the cost of other supplies.

Alternative 2

The general description of Alternative 2 provided for the Delta Region is valid for the Sacramento River Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 2A would include the South Delta and CVP/SWP conveyance improvements as proposed for Alternative 1C. Preliminary DWRSIM modeling studies and yield allocation assumptions

Economic Parameter	Impacts by Alternative (millions of dollars per year)																		
	Existing Conditions	No Action	Alternative 1			Alternative 2					Alternative 3								
			1a	1b	1c	2a	2b	2c	2d	2e	3a	3b	3c	3d	3e	3f	3g	3h	3i
CALFED water supply costs	0	0	No costs available																
Other water supply costs	0	0.1	0.1	0.1	-1.2	0	-1.2	0	-0.9	-1.2	0	-1.4	0	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
Total average costs																			
Drought conservation costs	0	2.6	2.6	2.6	2.0	2.6	2.0	2.6	2.5	2.0	2.3	1.4	2.3	1.4	1.4	1.4	1.4	1.4	1.4
Drought make-up supply costs	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total drought costs	1.9	2.6	2.6	2.6	2.0	2.6	2.0	2.6	2.5	2.0	2..3	1.4	2.3	1.4	1.4	1.4	1.4	1.4	1.4
Water quality costs																			
Water conservation costs																			

Note:
See notes from Table 4.

Table 6. Summary of Impact Analysis for the Sacramento River Region

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imply that the Sacramento River Region would gain about 500 AF in average years and 900 AF in dry years. From the M&I water supply economic analysis, these gains would provide for less than 0.1 percent of demand in average and dry years. The additional supplies are worth little ($100,000 annually) relative to the cost of other supplies.

Alternative 2C would provide three isolated South Delta conveyance facilities to deliver water to Clifton Court and the Tracy pumps, and a small amount of in-Delta storage would be developed. Preliminary DWRSIM modeling studies for Alternative 2C are the same as those for Alternative 2A; therefore, economic impacts are the same as those discussed for Alternative 2A.

Storage

Alternative 2B would add up to 5.5 MAF of surface storage and 1 MAF of groundwater storage to Alternative 2A. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C.

Alternative 2D would use a screened intake at Hood to divert water from the Sacramento River, a new channel for conveyance, and about 2 MAF of new storage south of the Delta. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Sacramento River Region would gain about 8,500 AF in average years and 4,100 AF in dry years. From the M&I water supply economic analysis, these gains would provide for less than 0.1 percent of demand in average and dry years. The average year supplies are worth $1.0 million annually, and the additional supplies in dry years are worth an additional $0.2 million relative to the cost of other supplies.

Alternative 2E would develop new conveyance, and up to 5.5 MAF of surface storage and 1 MAF of groundwater storage would be provided. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C.

Alternative 3

The general description of Alternative 3 provided for the Delta Region is valid for the Bay Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 3A would modify Alternative 2A by adding a 5,000-cfs isolated open facility, and Delta islands would not be flooded and used for conveyance as in Alternative 2A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Sacramento River Region would gain about 500 AF in average years and 2,300 AF in dry years. From the M&I water supply economic analysis, these gains would provide for less than 0.5 percent of demands. The average year supplies are worth $0.1 million annually, and the additional supplies in dry years are worth an additional $0.3 million relative to the cost of other supplies.

Alternative 3C would replace the open facility of Alternative 3A with a closed pipe. With this change, no additional effects relative to Alternative 3A are expected.

Storage

Alternative 3B would add 5.7 MAF of surface water storage and 1 MAF of groundwater storage to Alternative 3A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Sacramento River Region would gain about 12,300 AF in average years and 11,900 AF in dry years. These gains would provide for about 1.3 and 1.2 percent of demand in average and dry years, respectively. The average year supplies are worth $1.4 million annually, and the additional supplies in dry years are worth an additional $1.2 million relative to the cost of other supplies.

Alternative 3D would replace the open facility of Alternative 3B with a closed pipe. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3E would replace the 5,000-cfs isolated open conveyance facility of Alternative 3B with a 15,000-cfs facility, and the enlargement and barrier at the head of the Old River would be removed. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3F would provide cross-Delta conveyance by the chain of lakes concept. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B, except that conveyance losses might be increased.

Alternative 3G would locate the 5,000-cfs open isolated conveyance facility in Alternative 3B to the current Sacramento Deep Ship Channel on the west side of the Sacramento River. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3H would modify Alternative 3B by changing the amount and location of habitat and reducing in-Delta storage by 200 TAF, for a total of 5.5 MAF of storage. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3I would modify Alternative 2C by adding an additional isolated intake and other new storage up to 6.5 MAF. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

5.2.4 San Joaquin River Region

Table 7 provides a summary of the impact assessment for the San Joaquin River Region.

Alternative 1

The general description of Alternative 1 and the features of the each sub-alternative provided for the Delta Region is valid for the San Joaquin River Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Any water quality improvements would affect the San Joaquin River Region through SWP and CVP exports.

Water Quality

The nature and pattern of impacts are as described for the Delta Region, Alternative 1, except that water quality actions do not include Actions 4 and 6. The principal mine is the New Idria Mine in San Benito County.

Any water quality improvements would affect the San Joaquin River Region through SWP and CVP exports.

Water Use Efficiency

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Because the San Joaquin River Region generally has a lower than average level of conservation, additional costs of conservation per unit of water saved may be lower than average. CALFED Water Use Efficiency Input Report 5-1 describes preliminary water conservation baseline

	Impacts by Alternative (millions of dollars per year)																			
			Alternative 1			Alternative 2					Alternative 3									
Economic Parameter	Existing Conditions	No Action	1a	1b	1c	2a	2b	2c	2d	2e	3a	3b	3c	3d	3e	3f	3g	3h	3i
CALFED water supply costs	0	0	No costs available																	
Other water supply costs	0	-1.7	-1.7	-1.7	-3.4	-2.2	-3.4	-2.2	-2.6	-3.4	-2.5	-3.7	-2.5	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7
Total average costs																			
Drought conservation costs	0	7.0	7.0	7.0	6.6	7.0	6.6	7.0	6.8	6.6	7.0	6.4	7.0	6.4	6.4	6.4	6.4	6.4	6.4
Drought make-up supply costs	8.5	2.1	2.1	2.1	1.4	2.1	1.4	2.1	1.7	1.4	1.9	1.0	1.9	1.0	1.0	1.0	1.0	1.0	1.0
Total drought costs	8.5	9.1	9.1	9.1	8.0	9.1	8.0	9.1	8.5	8.0	8.9	7.4	8.9	7.4	7.4	7.4	7.4	7.4	7.4
Water quality costs						S	S		S	S					B				
Water conservation costs																			

NOTE:
See notes from Table 4.

Table 7. Summary of Impact Analysis for the San Joaquin River Region

levels and goals. Potential real water savings from M&I uses due to CALFED Water Use Efficiency Actions for UR-2 (the Eastside San Joaquin River) and UR-3 (the Tulare Lake Region) are estimated to be 41,000 to 53,000 AF annually.

Levee System Integrity

The nature and pattern of impacts are as described for Delta Region, Alternative 1. There is little potential impact, except as levee failure might affect Delta export operations.

Conveyance

Because Alternative 1A would include no additional storage or conveyance, no water supply benefits are expected.
Alternative 1B would include South Delta modifications to allow export pumps to operate at their physical capacity. For Alternatives 1A and 1B, preliminary DWRSIM results suggest that there will be no change in water supply and water supply economics. Also, preliminary water quality anaysis from DWR suggests that there will be no significant change in water quality.

Storage

Alternative 1C would build on Alternative 1B by enlarging Delta channels and by adding new water storage facilities. Up to 5 MAF of storage would be added. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the San Joaquin River Region would gain about 9,400 AF in average years and 12,100 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.3 percent of demand in average years, and 1.7 percent of demand in dry years. The average year supplies are worth $1.7 million in comparison to the costs of other supplies, and the additional supplies in dry years are worth an additional $1.0 million annually relative to the cost of other supplies. Preliminary water quality analysis results reported in Table 2 suggest that water quality changes will be minimal.

Alternative 2

The general description of Alternative 2 provided for the Delta Region is valid for the San Joaquin River Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 2A would include the South Delta and CVP/SWP conveyance improvements as proposed for Alternative 1C. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the San Joaquin River Region would gain about 3,000 AF in average years and 1,400 AF in dry years. From the M&I water supply economic analysis, these gains would provide for less than 0.5 percent of demand in average and dry years. The average year supplies are worth $0.6 million in comparison to the cost of other supplies, but the additional supplies in dry years have little additional value because the dry-year yield of the supplies replaced is about the same as the new CALFED supplies. Analysis of water quality effects are the same as those shown for the Bay Area, Alternative 2A.

Alternative 2C would provide three isolated South Delta conveyance facilities to deliver water to Clifton Court and the Tracy pumps, and a small amount of in-Delta storage would be developed. Preliminary DWRSIM modeling studies for Alternative

2C are the same as those for Alternative 2A; therefore, economic impacts are the same as those discussed for Alternative 2A.

Storage

Alternative 2B would add up to 5.5 MAF of surface storage and 1 MAF of groundwater storage to Alternative 2A. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C. Analysis of water quality economics is the same as shown for the Bay Area, Alternative 2B.

Alternative 2D would use a screened intake at Hood to divert water from the San Joaquin River, a new channel for conveyance, and about 2 MAF of new storage south of the Delta. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the San Joaquin River Region would gain about 5,400 AF in average years and 6,300 AF in dry years. These gains would provide for about 0.8 percent of demand in average years, and 0.9 percent of demand in dry years. The average year supplies are worth $1.0 million in comparison to the cost of other supplies. These supplies would have more value if they can be managed to meet demands in dry years. The additional supplies in dry years are worth an additional $0.5 million annually relative to the cost of other supplies. Analysis of water quality economics is the same as shown for the Bay Area, Alternative 2D.

Alternative 2E would develop new conveyance, and up to 5.5 MAF of surface storage and 1 MAF of groundwater storage would be provided. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C. Analysis of water quality economics is the same as shown for the Bay Area, Alternative 2E.

Alternative 3

The general description of Alternative 3 provided for the Delta Region is valid for the Bay Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 3A would modify Alternative 2A by adding a 5,000-cfs isolated open facility, and Delta islands would not be flooded and used for conveyance as in Alternative 2A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the San Joaquin River Region would gain about 4,600 AF in average years and 3,600 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 0.5 percent of demand in average years, and 0.7 percent in dry years. The average year supplies are worth $0.8 million in comparison to the cost of other supplies. The additional supplies in dry years are worth an additional $0.2 million annually relative to the cost of other supplies.

Alternative 3C would replace the open facility of Alternative 3A with a closed pipe. With this change, no additional effects relative to Alternative 3A are expected.

Storage

Alternative 3B would add 5.7 MAF of surface water storage and 1 MAF of groundwater storage to Alternative 3A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the San Joaquin River Region would gain about 11,200 AF in average years and 18,100 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.6 and 3.8 percent of demands in average and dry years, respectively. The average year supplies are worth $2.0 million, and the additional supplies in dry years are worth an additional $1.8 million annually relative to the cost of other supplies.

Alternative 3D would replace the open facility of Alternative 3B with a closed pipe. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3E would replace the 5,000-cfs isolated open conveyance facility of Alternative 3B with a 15,000-cfs facility, and the enlargement and barrier at the head of the Old River would be removed. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B. Analysis of water quality economics is the same as shown for the Bay Area, Alternative 3E.

Alternative 3F would provide cross-Delta conveyance by the chain of lakes concept. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B, except that conveyance losses might be increased.

Alternative 3G would locate the 5,000-cfs open isolated conveyance facility in Alternative 3B to the current Sacramento Deep Ship channel on the west side of the Sacramento River. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3H would modify Alternative 3B by changing the amount and location of habitat and reducing in-Delta storage by 200 TAF, for a total of 5.5 MAF of storage. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3I would modify Alternative 2C by adding an additional isolated intake and other new storage up to 6.5 MAF. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

5.2.5 Other SWP Service Areas

Table 8 provides a summary of the impact analysis for the Other SWP Service Areas.

Alternative 1

The general description of Alternative 1 and the features of the each sub-alternative provided for the Delta Region is valid for the Other SWP Service Areas as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Any water quality improvements or other benefits would affect the Other SWP Service Areas through Delta exports only. Costs and cost shares are currently unknown.

Water Quality

There is no water quality program targeted to this region because the region's watersheds do not drain to the Bay or Delta. However, water quality improvements in the Delta would affect the Other SWP Service Areas through SWP exports. Costs and cost shares are currently unknown.

Economic Parameter	Existing Conditions	No Action	Impacts by Alternative (millions of dollars per year): Alternative 1			Alternative 2					Alternative 3								
			1a	1b	1c	2a	2b	2c	2d	2e	3a	3b	3c	3d	3e	3f	3g	3h	3i
CALFED water supply costs	0	0	No costs available																
Other water supply costs	-91	601	601	601	466	556	466	556	521	466	534	442	534	442	442	442	442	442	442
Total average costs																			
Drought conservation costs	63	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310
Drought make-up supply costs	0	685	685	685	535	680	535	680	608	535	650	451	650	451	451	451	451	451	451
Total drought costs	63	995	995	995	845	990	845	990	918	845	960	761	960	761	761	761	761	761	761
Water quality costs					B	B	B		B	B					B				
Water conservation costs																			

NOTE:
See notes from Table 4.

Table 8. Summary of Impact Analysis for Other SWP Service Areas

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Water Use Efficiency

The nature and pattern of impacts are as described for the Delta Region, Alternative 1. Because the Other SWP Service Areas generally has a higher than average existing level of conservation, additional costs of conservation per unit of water saved may be higher than average. CALFED Water Use Efficiency Input Report 5-1 describes preliminary water conservation baseline levels and goals. Potential real water savings from M&I uses due to CALFED Water Use Efficiency Actions for UR-5 (the Central Coast), UR-6 (Southern California), and UR-7 (the Colorado River Region) are estimated to be 73,000 to 86,000 AF annually.

Levee System Integrity

The nature and pattern of impacts are as described for Delta Region, Alternative 1. There is little potential impact, except as levee failure might affect Delta export operations. The economic cost of Delta export disruptions is inversely related to the amount of south-of-Delta storage, but this effect is judged too small to warrant a comparison across alternatives.

Conveyance

Because Alternative 1A would include no additional storage or conveyance, no water supply benefits are expected. Alternative 1B would include South Delta modifications to allow export pumps to operate at their physical capacity. For Alternatives 1A and 1B, preliminary DWRSIM results suggest that there will be no change in water supply and water supply economics. Preliminary water quality results also suggest no difference from No Action conditions.

Storage

Alternative 1C would build on Alternative 1B by enlarging Delta channels and by adding new water storage facilities. Up to 5 MAF of storage would be added. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Other SWP Service Areas would gain about 138,100 AF in average years and 176,700 AF in dry years. These gains would provide for about 2.4 percent of demand in average years and 4.5 percent of demand in dry years. The average year supplies are worth $135.4 million in comparison to the cost of other supplies. These supplies would have even more value if they can be managed to meet demands in dry years. The additional supplies in dry years are worth an additional $150.6 million annually relative to the cost of other supplies. These supply values would be less if water transfers from the Central Valley were allowed as a supply option.

DWR has provided preliminary analysis of TDS of export water for Alternative 1C. The salinity analysis does not consider differences in the amount of storage and in the amount and timing of exports between alternatives. Rather, only differences in conveyance and intake configurations are modeled using DWR Run 472B hydrology. Results, in terms of average salinity of exports from Clifton Court, are summarized in Table 2. There is little difference in the TDS of exports between Alternative 1C and No Action, but the increase in deliveries results in increased dilution of lower-quality waters from other sources. Economic analysis is forthcoming.

Alternative 2

The general description of Alternative 2 provided for the Delta Region is valid for the Other SWP Service Areas as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 2A would include the South Delta and CVP/SWP conveyance improvements as proposed for Alternative 1C. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Other SWP Service Areas would gain about 44,600 AF in average years and 19,800 AF in dry years. These gains would provide for about 0.8 percent of demand in average years, and 0.3 percent in dry years. The average year supplies are worth $45.3 million in comparison to the cost of other supplies. These supplies would have more value if they can be managed to meet demands in dry years. The additional supplies in dry years have little additional value ($5.4 million) because the dry-year yield of the supplies replaced is about the same as the new CALFED supplies.

DWR has provided preliminary analysis of TDS of exports for Alternative 2A. Results, in terms of average salinity of exports from Clifton Court, are summarized in Table 2. There is a significant difference in the TDS of exports between Alternative 2A and No Action, and the increase in deliveries results in increased dilution of lower-quality waters from other sources. Economic analysis is forthcoming.

Alternative 2C would provide three isolated South Delta conveyance facilities to deliver water to Clifton Court and the Tracy pumps, and a small amount of in-Delta storage would be developed. Preliminary DWRSIM modeling studies for Alternative 2C are the same as those for Alternative 2A; therefore, economic impacts are the same as those discussed for Alternative 2A.

Storage

Alternative 2B would add up to 5.5 MAF of surface storage and 1 MAF of groundwater storage to Alternative 2A. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C. Economic analysis is forthcoming. Even without this analysis, it is believed that Alternative 2B will result in a significant economic benefit to the region from water quality improvement.

Alternative 2D would use a screened intake at Hood to divert water from the Other SWP Service Areas, a new channel for conveyance, and about 2 MAF of new storage south of the Delta. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Other SWP Service Areas would gain about 79,300 AF in average years and 91,700 AF in dry years. From the M&I water supply economic analysis, these gains would provide for about 1.4 percent of demand in average years and 1.5 percent of demand in dry years. The average year supplies are worth $79.5 million, and the additional supplies in dry years are worth an additional $77.3 million annually relative to the cost of other supplies.

DWR has provided preliminary analysis of TDS of exports for Alternative 2D. Results, in terms of average salinity of exports from Clifton Court, are summarized in Table 2. There is a significant difference in the TDS of exports between Alternative 2D and No Action, and the increase in deliveries results in increased dilution of lower-quality waters from other sources. Economic analysis is forthcoming.

Alternative 2E would develop new conveyance, and up to 5.5 MAF of surface storage and 1 MAF of groundwater storage would be provided. Preliminary DWRSIM results and water supply benefits are the same as those discussed for Alternative 1C.

DWR has provided preliminary analysis of TDS of exports for Alternative 2E. Results, in terms of average salinity of exports from Clifton Court, are summarized in Table 2. There is a significant difference in the TDS of exports between Alternative 2E and No Action, and the increase in deliveries results in increased dilution of lower-quality waters from other sources. Economic analysis is forthcoming. Even without this analysis, it is believed that Alternative 2E will result in a significant economic benefit to the region from water quality improvement.

Alternative 3

The general description of Alternative 3 provided for the Delta Region is valid for the Bay Region as well.

Ecosystem Restoration Program

The nature and pattern of impacts are as described for Alternative 1.

Water Quality

The nature and pattern of impacts are as described for Alternative 1.

Water Use Efficiency

The nature and pattern of impacts are as described for Alternative 1.

Levee System Integrity

The nature and pattern of impacts are as described for Alternative 1.

Conveyance

Alternative 3A would modify Alternative 2A by adding a 5,000-cfs isolated open facility, and Delta islands would not be flooded and used for conveyance as in Alternative 2A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Other SWP Service Areas would gain about 66,900 AF in average years and 52,100 AF in dry years. These gains would provide for about 1.2 percent of demand in average years, and 0.9 percent in dry years. The average year supplies are worth $67.4 million, and the additional supplies in dry years are worth an additional $35.3 million annually relative to the cost of other supplies.

Alternative 3C would replace the open facility of Alternative 3A with a closed pipe. With this change, no additional effects relative to 3A are expected.

Storage

Alternative 3B would add 5.7 MAF of surface water storage, and 1 MAF of groundwater storage to Alternative 3A. Preliminary DWRSIM modeling studies and yield allocation assumptions imply that the Other SWP Service Areas Region would gain about 163,600 AF in average years and 265,200 AF in dry years. These gains would provide for about 2.8 percent of demand in average years, and 4.4 percent in dry years. The Other SWP Service Areas Region in the 2020 average condition would require new water to meet demands, so the average year supplies are worth $158.8 million, and the additional supplies in dry years are worth an additional $234.6 million annually relative to the cost of other supplies.

Alternative 3D would replace the open facility of Alternative 3B with a closed pipe. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3E would replace the 5,000-cfs isolated open conveyance facility of Alternative 3B with a 15,000-cfs facility, and the enlargement and barrier at the head of the Old River are removed. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

DWR has provided preliminary analysis of TDS of exports for Alternative 3E. Results, in terms of average salinity of exports from Clifton Court, were summarized in Table 2. There is a significant difference in the TDS of exports between Alternative 3E and No

Action, and the increase in deliveries results in increased dilution of lower-quality waters from other sources. Economic analysis is forthcoming. Even without this analysis, it is believed that Alternative 3E will result in a significant economic benefit to the region from water quality improvement.

Alternative 3F would provide cross-Delta conveyance by the chain of lakes concept. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B, except that conveyance losses might be increased.

Alternative 3G would locate the 5,000-cfs open isolated conveyance facility in Alternative 3B to the current Sacramento Deep Ship channel on the west side of the Sacramento River. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3H would modify Alternative 3B by changing the amount and location of habitat and reducing in-Delta storage by 200 TAF for a total of 5.5 MAF of storage. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

Alternative 3I would modify Alternative 2C by adding an additional isolated intake and other new storage up to 6.5 MAF. No additional effects on M&I water use and costs are expected in comparison to Alternative 3B.

5.3 Summary of Comparisons by Region

Economic impacts of the Ecosystem Restoration, Water Quality, Water Use Efficiency, and Levee System Integrity Common Programs have not been quantified, primarily for lack of information on the magnitude of physical impacts and cost sharing. Impacts of water storage and water conveyance components are summarized by region in Tables 9 through 16. All of the analysis on which these tables are based is preliminary and subject to change.

6.0 References Cited

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Milliken Chapman Research Group, Inc., 1998. Estimating Economic Impacts of Salinity of the Colorado River. February.

Alternative	CALFED Water Storage Costs	Other Water Supply Costs	Water Quality Costs	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Increasing importance of stored water for water quality control.	Increasing.
No Action Alternative	None	Includes CVPIA and Los Vaqueros. Increased demand requires new supplies or more use of existing supplies, increasing costs.	Delta water quality deteriorates relative to existing conditions.	Small increase in real water costs and water prices, and conservation initiatives result in some water savings.
Alternative 1	Unknown	Alternative 1C reduces other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 2	Unknown	Alternatives 2B and 2E reduce other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 3	Unknown	All variations (except for Alternatives 3A and 3C include more storage, which reduces other water supply costs.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.

Table 9. Generalized Impacts of Alternatives on M&I Water Costs for the Delta Region—Water Storage

Alternative	CALFED Water Conveyance Costs	Other Water Supply Costs	Water Quality Costs[a]	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Conveyance capacity limits ability to move water when quality is better.	Increasing.
No Action Alternative	None	Increased demand may require more capacity, increasing costs.	Less excess capacity in 2020 means less ability to move water when quality is better.	Conservation may help relieve capacity constraints.
Alternative 1	Unknown	No substantial changes to conveyance and no quantifiable effect on supplies.	No quantifiable effect on water quality.	Without supply increase, no interaction between conveyance and conservation.
Alternative 2	Unknown	Changes to conveyance have little quantifiable effect on water supplies.	Significant improvement in source water quality in some years, effect of Alternative 2C is unknown.	Without supply increase, no interaction between conveyance and conservation.
Alternative 3	Unknown	Isolated facility increases water supply, but effect not considered significant.	Significant source water quality improvements not likely for Alternative 3E, others are unknown.	Without significant supply increase, no interaction between conveyance and conservation.

[a] Water quality analysis considered effects of different intake and conveyance configurations without analysis of interactions with storage or export amounts, or timing.

Table 10. Generalized Impacts of Alternatives on M&I Water Costs for the Delta Region—Water Conveyance

Alternative	CALFED Water Storage Costs	Other Water Supply Costs	Water Quality Costs	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Increasing importance of stored water for water quality control.	Increasing.
No Action Alternative	None	Includes CVPIA. Increased demand requires new supplies or more use of existing supplies, increasing costs.	Delta water quality deteriorates relative to existing conditions.	Small increase in real water costs and water prices, and conservation initiatives result in some water savings.
Alternative 1	Unknown	Alternative 1C reduces other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 2	Unknown	Alternatives 2B and 2E reduce other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 3	Unknown	All variations (except forAlternatives 3A and 3C) include more storage, which reduces other water supply costs.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discoura;;es conservation only if yield is less expensive than other water supplies.

Table 11. Generalized Impacts of Alternatives on M&I Water Costs for the Bay Region—Water Storage

Alternative	CALFED Water Conveyance Costs	Other Water Supply Costs	Water Quality Costs[a]	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Conveyance capacity limits ability to move water when quality is better.	Increasing.
No Action Alternative	None	Increased demand may strain conveyance capacity into the region.	Less excess capacity in 2020 means less ability to move water when quality is better.	Additional conservation may reduce capacity pressures.
Alternative 1	Unknown	No substantial changes to conveyance and no quantifiable effect on supplies.	No quantifiable effect on water quality.	Without supply increase, no interaction between conveyance and conservation.
Alternative 2	Unknown	Changes to conveyance have little quantifiable effect on water supplies.	Significant improvement in source water quality in some years, effect of Alterna-tive 2C is unknown.	Without supply increase, no interaction between conveyance and conservation.
Alternative 3	Unknown	Isolated facility increases water supply, but effect not considered significant.	Significant source water quality improve-ments likely for Alterna-tive 3E, others are unknown.	Without significant supply increase, no interaction between conveyance and conservation.

[a] Water quality analysis considered effects of different intake and conveyance configurations without analysis of interactions with storage or export amounts, or timing.

Table 12. Generalized Impacts of Alternatives on M&I Water Costs for the Bay Region—Water Conveyance

Alternative	CALFED Water Storage Costs	Other Water Supply Costs	Water Quality Costs	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Water quality generally not a problem.	Increasing, assume Level 1.
No Action Alternative	None	Includes CVPIA. Increased demand requires new supplies or more use of existing supplies, increasing costs.	Some deterioration of water quality relative to existing conditions.	Small increase in real water costs and water prices, and conservation initiatives result in some water savings.
Alternative 1	Unknown	Alternative 1C reduces other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 2	Unknown	Alternatives 2B and 2E reduce other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 3	Unknown	All variations (except for Alternatives 3A and 3C) include more storage which reduces other water supply costs.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.

Table 13. Generalized Impacts of Alternatives on M&I Water Costs for the Sacramento River Region—Water Storage

Alternative	CALFED Water Conveyance Costs	Other Water Supply Costs	Water Quality Costs[a]	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Water quality generally not a problem, not related to Delta conveyance.	Increasing.
No Action Alternative	None	Increased demand increases peak deliveries, but not through Delta.	Water quality deteriorated, but still not a big problem.	Little interaction between conservation and Delta conveyance.
Alternative 1	Unknown	No substantial changes to conveyance and no quantifiable effect on supplies.	No quantifiable effect on water quality.	Without supply increase, no interaction between conveyance and conservation.
Alternative 2	Unknown	Changes to conveyance have little quantifiable effect on water supplies.	No quantifiable effect on water quality.	Without supply increase, no interaction between conveyance and conservation.
Alternative 3	Unknown	Isolated facility increases water supply, but effect not considered significant.	No quantifiable effect on water quality.	Without significant supply increase, no interaction between conveyance and conservation.

[a] Water quality analysis considered effects of different intake and conveyance configurations without analysis of interactions with storage or export amounts, or timing.

Table 14. Generalized Impacts of Alternatives on M&I Water Costs for the Sacramento River Region—Water Conveyance

Alternative	CALFED Water Storage Costs	Other Water Supply Costs	Water Quality Costs	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Increasing importance of stored surface water.	Increasing.
No Action Alternative	None	Includes CVPIA. Increased demand requires new supplies or more use of existing supplies, increasing costs.	Delta water quality declines relative to current conditions, more use of surface water to substitute for degraded groundwater.	Small increase in supplies, real water costs and water prices, and conservation initiatives result in some water savings.
Alternative 1	Unknown	Alternative 1C reduces other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 2	Unknown	Alternatives 2B and 2E reduce other water supply costs with 5 MAF of new storage.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 3	Unknown	All variations (except for Alternatives 3A and 3C) include more storage which reduces other water supply costs.	Effects of storage on water quality cannot be judged with existing results.	Increased storage discourages conservation only if yield is less expensive than other water supplies.

Table 15. Generalized Impacts of Alternatives on M&I Water Costs for the San Joaquin River Region—Water Storage

Alternative	CALFED Water Conveyance Costs	Other Water Supply Costs	Water Quality Costs[a]	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Conveyance capacity limits ability to move water when quality is better.	Increasing.
No Action Alternative	None	Increased demand increases peak deliveries.	Less excess capacity in 2020 means less ability to move water when quality is better.	Little interaction between conservation and conveyance.
Alternative 1	Unknown	No substantial changes to conveyance and no quantifiable effect on supplies.	No quantifiable effect on water quality.	Without supply increase, no interaction between conveyance and conservation.
Alternative 2	Unknown	Changes to conveyance have little quantifiable effect on water supplies.	Significant improvement in source water quality in some years, effect of Alt 2C unknown.	Without supply increase, no interaction between conveyance and conservation.
Alternative 3	Unknown	Isolated facility increases water supply, but effect not considered significant.	Significant source water quality improvements likely forAlternative 3E, others unknown.	Without significant supply increase, no interaction between corveyance and conservation.

[a] Water quality analysis considered effects of different intake and conveyance configurations without analysis of interactions with storage or export amounts, or timing.

Table 16. Generalized Impacts of Alternatives on M&I Water Costs for the San Joaquin River Region—Water Conveyance

Alternative	CALFED Water Storage Costs	Other Water Supply Costs	Water Quality Costs	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Increasing importance of stored water for water quality control.	Increasing.
No Action Alternative	None	Increased demand requires new supplies or more use of existing supplies, increasing costs.	Delta water quality deteriorates relative to existing conditions.	Moderate increase in supplies, real water costs and water prices, and conservation initiatives result in water savings.
Alternative 1	Unknown	Alternative 1C reduces other water supply costs with 5 MAF of new storage.	Effects of storage on quality cannot be judged with existing results; increased delivery from Alternative 1C should reduce water quality costs.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 2	Unknown	Alternatives 2B and 2E reduce other water supply costs with 5 MAF of new storage.	Effects of storage on quality cannot be judged with existing results. Increased delivery from Alternatives 2B and 2E should contribute to significantly reduced water quality costs.	Increased storage discourages conservation only if yield is less expensive than other water supplies.
Alternative 3	Unknown	All variations (except for Alternatives 3A and 3C) include more storage, which reduces other water supply costs.	Effects of storage on water quality cannot be judged with existing results. Increased delivery fromAlternative 3E should contribute to significantly reduced water quality costs.	Increased storage discourages conservation only if yield is less expensive than other water supplies.

Table 17. Generalized Impacts of Alternatives on M&I Water Costs for Other SWP Service Areas—Water Storage

Alternative	CALFED Water Conveyance Costs	Other Water Supply Costs	Water Quality Costs[a]	Water Conservation Costs
Existing Conditions	None	Many sunk costs, some excess capacity.	Conveyance capacity limits ability to move water when quality is better.	Increasing, assume Level 1.
No Action Alternative	None	Less excess capacity, especially from Colorado River system.	Less excess capacity in 2020 means less ability to move water when quality is better.	Little interaction between conservation and conveyance.
Alternative 1	Unknown	No substantial changes to conveyance and no quantifiable effect on supplies.	No quantifiable effect on water quality.	Without supply increase, no interaction between conveyance and conservation.
Alternative 2	Unknown	Changes to conveyance have little quantifiable effect on water supplies.	Significant improvement in source water quality in some years, effect of Alternative 2C is unknown.	Without supply increase, no interaction between conveyance and conservation.
Alternative 3	Unknown	Isolated facility increases water supply, but effect not considered significant.	Significant source water quality improvements are likely for Alternative 3E, others are unknown.	Without significant supply increase, no interaction between conveyance and conservation.

[a] Water quality analysis considered effects of different intake and conveyance configurations without analysis of interactions with storage or export amounts, or timing.

Table 18. Generalized Impacts of Alternatives on M&I Water Costs for Other SWP Service Areas—Water Conveyance

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